# INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

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# ARTIFICIAL INSEMINATION

AMONG recent advances made in Animal Husbandry Science nothing has probably gripped the attention of the stockman as the spectacular results following intensive studies in the physiology of reproduction. In that connection the branch which has held out much hope of profitable application is undoubtedly artificial insemination. It would be a truism to say that the progressive Indian farmer either waits impatiently for the result of its application which, he anticipates, must eventually be forthcoming, or cynically views the whole subject as just one more impracticable scientific crudity which for the moment is being forced upon his attention.

The term insemination means neither fertilizing nor impregnation. It simply signifies the placing of the male reproductive fluid into the genetical tract of the female, and thereafter the process of reproduction proceeds naturally. Almost the whole virtue of the procedure lies in the fact that by it the amount of semen, that is the fluid which carries the male fertilizing cells, used on any given female, can be controlled and thus conserved. Translated into practical terms, it means that in this way one male can fertilize many more females than the natural act allows. Nature in her productive processes is profusely liberal in her agents and in none so much perhaps as in the male reproductive cell. A cubic centimeter of stallion sperm or semen contains over a million male cells, only one of which may eventually join with the single female cell to produce the foetus. By controlling the amount expended upon each female, and by suitable dilution, truly spectacular results can be and have been obtained. For instance, in the Soviet Union as many as 1,000 cows have been inseminated by one bull in a season and 15,000 ewes by one ram. That, of course, is exceptional; in fact it is very exceptional, but it does show to what length the process may be exploited. Although that dilution of semen is exceptional, the number of animals treated is certainly not, for it is a fact that over 6 million cattle and sheep were artificially inseminated in the Soviet Union alone in 1936 and quite a large number were treated in certain other countries, for instance, in Italy and in Kenya.

After careful and highly skilled study, the factors which affect the life of the reproductive cells outside the body have been discovered, and with an understanding of their influence, ways have been devised, whereby it is possible to maintain the cells active for days outside the body and even allow of their transportation over long distances. By such means a female in one country may be impregnated by a male in another country, perhaps hundreds of miles away. When it is realized to what extent semen can be conserved and what ability it has to maintain its virtue outside the body, one feels that one can hardly exaggerate the potentialities of the process in its application to Indian livestock, among which sires of right quality are so few and the need for them so great.

Unfortunately, everything is not just as easy as a superficial knowledge of the subject might lead one to suppose. In practice the local difficulties are many, but none would appear to be insuperable. Till recently practically no study of the subject has been undertaken in India, but it is now in hand and in due course an authoritative appreciation of at least the more common difficulties may be expected. It should then be possible to estimate more reliably the chances of success and how it may be achieved.

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The advantages of the process are so apparent that one is apt to forget the other side of the picture and to overlook the possible dangers. Let it be said at once that in the hands of a practitioner, who is thoroughly acquainted with the anatomy both of the male and female reproductive organs of the domestic animals and who has some experience of their manipulation, the process is harmless to the individual. The greatest danger lies in the facility which the process gives of implementing, perhaps to an irretrievable extent, a breeding policy which may eventually prove to be inimical to the breed or to the herd, a danger which is a very real one in India. One is perhaps rather apt to decry the quality of Indian cattle and yet, judged by what is, after all, the ultimate and only criterion, viz. the suitability of the stock to its environment and use, India may be proud of the many admirably adapted breeds which she possesses. On the other hand, as is well known, a very large number of cattle, when put to any standard, fall far short of what is required and it is to them that the process invites attention. Before using it, however, one must be certain that the selected sire is, in fact, the animal he is taken to be, that he transmits the quality he himself has or his parents had, that his progeny are not inferior to himself, that his qualities are those which it is desired that his progeny should inherit, that they will blend with those of the females with which it is intended to mate him, that the expected improvements he is to introduce are compatible with the environment in which they are to develop and that they will not merely be an extravagance which the countryside cannot support. These questions and many others, which, of course, must be decided before commencing the execution of any breeding policy, ought to receive most earnest study when rapid and intensive multiplication is to be undertaken.

Once such questions of major policy have been decided, however, there is no reason why, provided the personnel, the apparatus and the material are available, attempts should not be made to exploit the practice. The first essential is that the intended practitioner should acquire the necessary skill in manipulation both of the animal and the delicate sperm; the second is the provision of apparatus and facilities best suited to the special conditions of the country; and the third is the acquisition of a male which has been proved to be a transmitter of the desired qualities. At first no great degree of proficiency should be looked for, but, as experience accumulates, one has a right to expect that either the process will give as good returns to India as it has done elsewhere or that the reasons why it cannot do so can be explained.

## J. C. McDOUGALL

C.I.E., M.A., B.Sc., I.A.S.

### An appreciation

JAMES CURRIE McDOUGALL was born in January 1890 in Western Argyll, in the Highlands of Scotland. His family has long had connections with agriculture and young McDougall showed a passion for farming from his early days. After passing his matriculation he took up farming for some time in his native country. He then joined the Edinburgh University and took his M.A. and B.Sc. in Agriculture. During the last Great War (1914-18) he served with the British infantry in Mesopotamia and was also with the 'Dunsterforce' in the Baku region of the Caucasus. In 1920 he joined the Indian Agricultural Service and came to the Central Provinces. He served as Assistant Director or Deputy Director of Agriculture in various parts of the province till 1926, when he was selected as the Assistant Secretary to the Royal Commission on Agriculture in India. In this capacity he had the opportunity of touring throughout the length and breadth of the country and of studying agricultural conditions of the various provinces at first hand, an opportunity vouchsafed to only a few at so early a stage in service. In 1930 when the post of Deputy Director of Agriculture, Economics and Marketing was created by the Central Provinces Government he was appointed to that post, and it was then that he organized the Verum Cotton Pools, a marketing organization unique in India, and which proved remarkably successful. In 1932

The advantages of the process are so apparent that one is apt to forget the other side of the picture and to overlook the possible dangers. Let it be said at once that in the hands of a practitioner, who is thoroughly acquainted with the anatomy both of the male and female reproductive organs of the domestic animals and who has some experience of their manipulation, the process is harmless to the individual. The greatest danger lies in the facility which the process gives of implementing, perhaps to an irretrievable extent, a breeding policy which may eventually prove to be inimical to the breed or to the herd, a danger which is a very real one in India. One is perhaps rather apt to decry the quality of Indian cattle and yet, judged by what is, after all, the ultimate and only criterion, viz. the suitability of the stock to its environment and use, India may be proud of the many admirably adapted breeds which she possesses. On the other hand, as is well known, a very large number of cattle, when put to any standard, fall far short of what is required and it is to them that the process invites attention. Before using it, however, one must be certain that the selected sire is, in fact, the animal he is taken to be, that he transmits the quality he himself has or his parents had, that his progeny are not inferior to himself, that his qualities are those which it is desired that his progeny should inherit, that they will blend with those of the females with which it is intended to mate him, that the expected improvements he is to introduce are compatible with the environment in which they are to develop and that they will not merely be an extravagance which the countryside cannot support. These questions and many others, which, of course, must be decided before commencing the execution of any breeding policy, ought to receive most earnest study when rapid and intensive multiplication is to be undertaken.

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J. C. McDougall, C.I.E., M.A., B.SC., I.A.S.
Late Director of Agriculture, Central Provinces

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he was appointed the Principal of the College of Agriculture, Nagpur, and he continued in that capacity till 1935, when he was promoted to the post of Director of Agriculture.

As Principal, Mr McDougall took a keen interest in all matters concerning the welfare of the students and the prospects of the graduates. It was during his term that agricultural graduates were made eligible by the Nagpur University to sit for the M.A. degree examination in Economics and also for the LL.B. examination, after attending the usual lectures. The question of instituting a degree for post-graduate work in agriculture was also mooted about the same time. The provincial Government was also induced to make certain amendments in the rules regarding recruitment to the Subordinate Civil Service and agricultural graduates were given the same status and privileges as graduates in science. These measures increased the prestige of the College and the prospects of the graduates.

When Mr McDougall became Director of Agriculture, the province was still in the grip of an acute financial depression and the state of the provincial finances did not permit any great expansion in the activities of the Department. But he turned to the Imperial Council of Agricultural Research and the Indian Central Cotton Committee for help in financing various schemes of development and in subsequent years very many research schemes of far-reaching character were started. These included research on important crops of the province, i.e. wheat, rice, millets, pulses, oilseeds and fibre and also schemes for the distribution of improved seeds and for the popularization of improved methods of cultivation.

Mr McDougall possessed a thorough knowledge of the rural and agricultural conditions of the province and very clear ideas on the various problems and their solution. Schemes prepared by him were always eminently practical and at the same time comprehensive. The Scot's instinct in him always wanted to be sure that they were 'paying concerns'. The Sherala (Berar) model project scheme prepared by him was commended by the Imperial Council of Agricultural Research as a model to follow and the scheme itself was published in INDIAN FARMING.

He always avoided publicity and the limelight and preferred to work in his own silent and unobtrusive manner. He was systematic and thorough in every thing he did. As head of the Department of Agriculture, Mr McDougall maintained a very high standard of work. He had an infinite capacity for taking pains. In recent years on account of the various development schemes and the 'grow more food' campaign the pressure of work was extremely heavy and for months together working round the clock was a normal routine for him. All the same he would not allow the quality of his work to suffer. This has won for him the confidence and respect of all who came in contact with him. Government recognized his valuable services by conferring the C. I. E. on him in the New Year's Honours of 1943.

He had a very keen sense of justice and even the worst offender in the Department had the confidence that his case would receive the fullest consideration. He expected every man to do his duty and to give no room for any unpleasantness. He always tried to understand the other man's viewpoint and to appreciate his difficulties and was ever ready to help and advise.

This appreciation would not be complete without a reference to Mrs McDougall. She was connected with most of the social activities in Nagpur and her geniality has won her many friends. In recent years the separation from their children, who were sent to Canada, has been a matter of grave concern to them and has probably been responsible for the early retirement of Mr McDougall from service. Their sudden departure from Nagpur did not give an opportunity to their many friends and admirers in the Department even to bid farewell to them. It is understood that they have reached home safely and that Mr McDougall has already taken up a war-time appointment. We wish them long life and all happiness and prosperity.

# Original Articles

## ESTABLISHMENT OF DEMOBILIZED SOLDIERS ON LAND

By R. Maclagan Gorrie, D.Sc.

Recruiting 60,000 men a month on an average for four years has swelled the peacetime Indian Army from 250,000 to somewhere in the neighbourhood of two million men. Well over half of the recruited men are villagers and wish to return to their own villages when released from the Army. In order of priority by numbers recruited for the Army the Punjab is first with nearly a million, then Madras with 400,000, U. P. with 300,000 Bombay with 200,000 and Bengal with 100,000.

### *The land available*

When these figures are compared with the net sown area of each province we find some surprising anomalies, for the Punjab even with its enormous extensions of canal irrigation of the last 40 years still has less land under crops than either Bombay, Madras or U. P. and only about the same area as Bengal, Bihar with Orissa and the C. P. with Berar. The N. W. F. P. also comes off very badly in this comparison with what seems to be a ridiculously small area of crop land for its population. It is thus obvious that the Punjab and the N. W. F. P. are going to have the most difficult task when it comes to settling their demobilized soldiers. Then also we have to cater for the returning factory hands when war supply activities close down. They also will have to be provided for, and may not be so easy as the soldier to deal with, because they have not learned the soldiers' discipline and because they may be jettisoned upon the country in indigestible crowds from the sudden closing down of large industrial units. Many of these men will have learned to appreciate a standard of living considerably higher than the old-fashioned village life, the soldiers through seeing conditions in foreign countries and the factory hands through having earned higher wages in the towns. From the typical cultivators' household, say a Jat in Gurgaon or an Awan in Jhelum district, two out of three adult sons may have joined up. Can these all be reabsorbed into the households they have left ? Some may be lucky and have a home awaiting them, but many must strike out afresh if they are ever to establish homes and families of their own. Roughly in the ratio of recruiting therefore the various provinces must be prepared to find homes for a fairly high percentage of the recruited totals, plus an additional figure of workers which is highest in the case of Bengal. Now what land is actually available for these men ? The revenue figures for each province show large areas of 'uncultivated waste' but those who know the land in detail will hasten to assure you that little of this is cultivable in its present condition. Only a careful field-to-field survey by one who knows the potentialities of derelict land under any given set of climatic, soil, and water-supply conditions, could give an accurate figure for each province. As an example, let us take the Punjab which has about 13 million acres of *barani* cultivation (dependent on rains alone, not irrigation) and about 4 million acres of uncultivated waste. Much of this so-called waste is already under a destructive regime of intermittent 'subsistence' ploughing, that is, the poorest type of farming which seldom produces any useful financial return or improvement of the land. Out of these 17 million acres at a very rough guess possibly 10 million acres are capable of a higher standard of land use, but only after a great deal of terracing, *bunding*, or ridging and subsoil ploughing has been done. In addition, possibly 6 million acres now under intermittent cultivation, though shown in revenue returns as 'cultivated', are actually allowed to be fallow or derelict for three years out of four, and could be made fit for regular cropping if a larger percentage of the total rain could be caught adn held in the soil to help raise a subsequent crop.

Similarly, in the U. P. and the C. P. enormous areas of land now under destructive and intermittent cultivation, with gentle slopes suffering more or less continuously from sheet erosion, could be made to carry a much larger population per square mile if each field were replanned, terraced and relevelled so as to ensure a better

absorbtion of the available rainfall, particularly in storing water in the latter half of the monsoon to make it available in the soil itself for raising a subsequent crop. Much of the suffering and near-famine conditions of 1938 to 1940 in Katni and other areas of the C. P. plateau land could have been avoided by adopting some form of collective farming the aim of which would be to bring every field to a maximum of efficiency in terms of water storage. Slopes must be terraced until each field retains the water which falls on it. This also applies throughout the whole of the drier parts of Bombay and Madras provinces and in the broken country of Bihar. In each of the major provinces mentioned, there must be somewhere in the neighbourhood of 10 to 12 million acres requiring urgent attention along these lines, and in the major States of Kashmir, Hyderabad, Mysore, Gwalior, Baroda, there is as much scope. The smaller states of the Punjab, Rajputana, Central India and Chhota Nagpur also offer vast areas for improvements. Taking 10 per cent of the net sown area, half of the current fallow, half of the cultivable waste, quarter of the non-available waste and 10 per cent of the village forest land, we get a total of 140 million acres for British India and 30 million for the Indian States of land that could be improved.

### *Cultivable land*

The data for irrigation projects are more accurately known. The total irrigable land not yet commanded by one or other of the canal projects is relatively small. Extensions of the Western Jumna Canal and new projects for dams in Sirmoor State may provide afresh half a million acres in the Punjab. Improvements on the Eastern Jumna and Sarda Canals of the U. P. may yield 100,000 acres and extensions of tube well irrigation will give a further 50,000 acres. But the total of potential new land is small and we are forced to the same conclusion as where the United States land frontiers have been so continuously extended that the people now say, the only frontier left to them is the land beneath their feet.

Much attention has already been given by Government and the technical services to possible extension of irrigation projects. It is, therefore, proposed to deal here only with non-irrigated land, that is to say, land not at present commanded by water from irrigation canals or wells. From the figures given above, it must be realized that millions of acres quoted are only a rough guess, particularly in the case of the Indian States, as no comprehensive survey has been carried out on a field-to-field basis to determine the correctness of this estimate.

### *Improvement of cultivated land*

The best chance of allocating reasonably sized holdings to returned soldiers is where consolidation of holdings has taken place. Without consolidation it is more or less impossible to get compact blocks of fields. Consolidation is a long-term project and can only be undertaken by a few villages at a time and with the help of specially trained staff, so that this cannot be the solution on a very big scale. It should, however, be possible to supplement the consolidation staff already trained and speed up this movement. In the Punjab there is already a big programme of consolidation going on but the rate of progress is necessarily slow, while in other provinces progress along this line is slight.

The technique of water conservation field by field on *barani* land, and particularly on the gently rolling slopes of badly-eroded uplands, cannot be handled effectively by individual cultivators and must be planned on a collective basis, taking each small water catchment area as a unit for the replanning of levels and terraces. It has already been attempted in some of the Punjab districts by the Soil Conservation and Cooperative staffs working together, and in Baroda and Jodhpur by the State Departments.

### *Fresh cultivation*

Throughout our rolling uplands there are many large blocks of land now practically unproductive which could be planned afresh in terms of run-off control, the alignment of field terraces, and the subsoil ploughing of the fields thus re-levelled. Admittedly, much of this land is exceedingly poor in its present condition and any attempts by individuals to bring it under cultivation would only result in an extension of subsistence ploughing and its consequent evils. Collective action under the control and assistance of Government is the only way to ensure success, and if this help is given, we visualize the possibility of planting very large numbers of men and their families in entirely new villages in areas at present almost unproductive.

The extreme type of derelict lands is seen in the 'bad lands' of the northern slopes of Jhelum

Salt Range and Rawalpindi district where whole tracts of country are so cut up by gullying as to be quite beyond reconditioning except by the most heroic measures. Such measures have however been proved practicable, and even the worst areas of deeply gullied uplands can be brought once again under the plough by the use of mechanical tractors, road-graders, bulldozers, heavy subsoil ploughs, and even where necessary by the use of explosives.

### *Use of machinery*

Most people think of mechanized farming as being only valuable in solving the problem of lack of man-power. The common impression is, therefore, that mechanization displaces men from the land, but this need not necessarily be true. If the mechanical forces now at our disposal are used primarily for putting land into a condition fit for cultivation, we can get the advantage of both systems. Powerful machinery will allow us to make land cultivable by levelling and contouring on a scale that has previously been out of the question with man-power only. It is not proposed to do the day-to-day cultivation with machinery, because a high output per man can be obtained by preserving individual ownership and the careful attention to crops which goes with it. The combination of mechanics on a broad scale with intensive farming by the individual can combine to give us a high output per man with a high output per acre and this is exactly what we need to ensure a good living for the ex-servicemen where cultivable land is scarce. By means of powerful mechanical road-graders and bulldozers, many millions of acres at present yielding only irregular and unsatisfactory crops can be brought under regular and useful cultivation, the primary object being to put the land in such a condition that whatever rain falls on it will be caught and held in the soil itself. The types of machine advised will naturally vary with the land on which we wish to establish contour farming. The replanning of every field on the basis of contour bunds, terraces, walls or ridges is recognized as the chief principle on which water conservation must depend. There are rolling foothills with sudden alterations in slope which need stone or turf walls at frequent intervals more or less on the same lines as hill rice cultivation, but with each field forming a saucer. Next we have relatively flat land which needs broad, low ridges running along the contour and laid out by means of a careful levelling survey which will take advantage of minor changes in level to dam back all the rain until it sinks into the ground. Another type is the badly gullied lands, such as are found in the Jhelum Salt Range and along the Chambal and other ravines in the U.P. In such places a complete redesigning of the landscape is needed by throwing down the isolated pyramids of eroding soil and laying land out afresh in terms of reasonably sized fields stepped down the slope and with drainage channels provided to deal with excessively heavy run-off. In all these types care has to be taken to provide for the very occasional but terrific rainstorm which is liable to break down our systems of terraces and ridges, though such a storm may only occur at an interval of many years.

Almost any type of earth-moving machinery can be made use of. For the more level lands the heavy bulldozer with a broad scoop is the most economical, whereas on steeper slopes a separate trailer plough or a small scoop pulled by a separate power unit is easier to handle.

### *Water storage in the soil*

Having established the main lines of contour ridges for any given area so that the whole cultivable surface will trap and hold all the rain water which falls on it, it still remains essential to bring the soil into a most receptive condition and this can best be done with pre-monsoon deep ploughing. The ideal instrument for this type of work is the 'Killefer' deep ploughing attachment which has been used successfully on several farms in the Punjab and in Jodhpur State. This instrument consists of a strong and heavy vertical shaft at the base of which is a small shoe. The action of this is to disturb the subsoil layer with a shattering motion which breaks up the 2 ft. earth deep into clods, but which leaves the top soil relatively undisturbed and still on the top. The advantage of this as compared with any over-turning action must be obvious to those who have experienced bitter disappointments where deep ploughing has brought to the surface an unweathered subsoil. The two main agencies in India for farming machinery are McCormick Deering for Adams graders through Volkart's and W. Jacks for 'Killefer' equipment. It is essential to work out the acreage per machine which can be consolidated and contoured, so that trained staff can match machine activity. So far as we have been able to ascertain, conditions for the

Middle-West American belt where the rainfall is just as critically low as in the southern Punjab, subsoiling of deep alluvial soils is recognized as the best preparation for the storage of storm water. In areas of rocky or rubbly subsoil, subsoiling will almost inevitably give a poor crop for a period of years after the subsoiling operation, but against this we should be prepared to set the fact that in areas of critical rainfall, better farming can only be attempted where we can store up water in the soil itself.

Another important factor is the distribution of accessible underground water-supply in areas of low rainfall. Sir William Stampe has made a survey by which he hopes to show what areas of southern Punjab can be improved by tapping underground water. Wherever this is feasible, it is obviously the first line of attack in our campaign of improving the water-supply for cultivation.

The second line of attack is by the extension of existing canal facilities for pouring monsoon water on to land prepared for its storage. This type of cultivation has been ably demonstrated on the New Delhi Experimental Farm. The figures of crop improvement are of the utmost interest and past experiments show clearly what can be done by way of stepping up the standard of cropping from a bare subsistence level, with the constant fear of failure, to a more assured form of cultivation.

The third type of land is that in which no underground supplies are available and assured irrigation has not previously been considered feasible. It is on such land that the most spectacular results can be shown through an intensive system of water conservation. This must combine, so far as possible, the three forms in which water is available, i.e. underground supply, canal supply and rainfall. Where neither of the first two are regularly available, the monsoon rainfall down to as low as 8 in., if fully conserved and stored, will ripen a *rabi* crop.

A figure of 20 million acres has been given as the area of possible improvement of the semi-arid tract stretching from Delhi to Multan through Gurgaon, Rohtak, Hissar, Karnal, Ambala and the adjoining state areas. The amount of money wasted in seed and labour through frequent crop failures is most startling. In these five districts in the five-year period 1934-39, 1·8 million acres were not cropped at all and of the sown area of 26·44 million acres, only 15·53 million acres produced a mature crop and 10·91 acres failed. Much of this tract could have some form of water storage treatment applied to it directly by an extension from the available canals and much more could be attempted elsewhere in this tract by rain water conservation, because most of it lies within the 10 in. to 20 in. rainfall belt. The August flood discharge for the Sutlej river which runs through the middle of this tract varies from 75,000 cusecs to a maximum of 150,000 cusecs. The behaviour of the river in cusecs is roughly as follows:

| | | |
|---|---|---|
| December to March | .. | 4,000 |
| April | .. | 5,000 |
| May | .. | 8,000 |
| June | .. | 20,000 |
| July | .. | 50,000 |
| August | .. | 75,000 to 150,000 |
| September | .. | 25,000 |
| October | .. | 7,000 |

Part of our problem is how to get a larger share of August flood water into the land instead of its going down to the sea.

### *Roads*

The Indian Roads and Transport Development Trust is a survey—a 'pilot survey' for road reconstruction in two sample areas, wet and dry. An essential part of any agricultural development project is a road programme which will provide for (i) direct pucca roads from each village to the nearest arterial road and railway, (ii) roads fit for machines to reach every block of fields, and (iii) road drainage which will not increase the gullying danger.

In the Bombay Scheme, the wet area is Panrel and Kharjat talukas in Colaba district and the dry one is Khatav taluka in Sitara district. The total actual cost is Rs. 61 lakhs, the interest on which is Rs. 4·13 lakhs, against which the annual value of benefits received will be Rs. 11·69 lakhs at a very conservative estimate. This estimate does not include any valuation for the type of drastic land improvement such as we are now advocating, but the two types of project are complementary and should obviously be linked up. An individual example of the enhancement of land values where soil conservation process has been applied to more or less derelict tract along the Rawalpindi-Murree road is an increase in the sale price of land from Rs. 3 to Rs. 93 per acre in three years. This may be exceptional ; but a safe figure of a 400 per cent jump from Rs. 20 to Rs. 80 is a reasonable expectation, where good roads and good agriculture go hand in hand.

# MECHANIZATION OF INDIAN VETERINARY SERVICES[1]

By J. B. Polding

*Imperial Veterinary Research Institute, Mukteswar*

THE progress of world events has set all men of active intelligence to pondering the advent of a new constructive era in India. What is in store for the veterinary services of the country? Presently, the Indian Army will disgorge a number of young veterinarians, who will not only merit their country's praise and consideration, but who will be trained in a new tradition—a tradition of swift mechanized communications—a tradition of efficiency based on speed. Furthermore, concurrently with the disposal of cheap army vehicles, a phase of rapid extension of Indian village roads is almost certain to occur during the first decade of peace.

Clearly, then or never, opportunity will stare the post-war veterinarian in the face, an opportunity opening wide the path to a greater use of preventive veterinary medicine.

### *Functions of veterinary service*

All intelligent thinkers will agree that the most important functions of a state veterinary service are, (1) the speediest possible diagnosis and effective control of infectious diseases, and (2) an unremitting prosecution of livestock improvement schemes. Now the first function demands a rapid, easy and ever-available transport system between veterinary headquarters and the villages, and the second calls for a comprehensive intimacy with the countryside that can only be acquired by a constant intercourse with the cultivator; an intercourse again made possible only by free and easy transit. It is the writer's belief that most of the deficiencies of our present field service arise from the inflexibility of the train-bus-bicycle-tonga complex, or in other words from crude communications. A first result of this complex is that a veterinary officer, who has to use these communications, reaches his destination exhausted and hours later than he could arrive if modern modes of transport were used. Such waste of efficiency and time is indefensible, especially in an emergency. Furthermore, as most of the duties concerning cattle must be done in the early morning before grazing, or in the evening after grazing, work carried out by a flexible means of transport could be agreeably done in a few morning or evening hours of a single day, while the same work performed under the existing conditions might often take most of the day, a night and much of the day following. In an efficient organization it is intolerable that a task requiring a few hours should take the better part of two days, while to spend the night away from headquarters is again undesirable, as the veterinarian loses touch with headquarters and work often is done by an unqualified person. Clearly then, the present transport difficulties must be obviated by the use of motor transport.

Some cattle epidemics are difficult to distinguish without special apparatus and special knowledge; but an epidemic must be diagnosed at the earliest possible moment. Now a motor vehicle can not only reach in a few hours the affected area, but, unlike the cruder methods of transport, it can carry, if properly equipped, the veterinary staff, diagnostic materials, and means of immediate treatment from the hospital directly to the field casualty. A not-infrequent train of events enforced by the present crude system of communications is the late arrival of an under-equipped veterinarian resulting in a guess-work type of diagnosis and usually followed by a second delayed visit for treatment. The alternative, if the cause of the disease is obscure, is for the veterinarian to return to headquarters, write to the parent laboratory for diagnostic apparatus, revisit the field to take samples, wait a week for a diagnosis and finally to return to the field for the treatment. In the meantime, the sick animals have possibly died and the whole laborious process has been without purpose. Plainly, the veterinarian of the past could not be supplied with and carry the necessary equipment for correct diagnosis and treatment at a single visit. This was partly because of the expense of equipping the enormous number of veterinarians required to cover India by the old transport systems, and mainly, because such a large body of men could not easily be trained and supervised. The mechanized veterinarian, on the other hand, with his speed

[1] A digest of an article submitted for publication in *Current Science*.

and mobility can cover the same territory as that which by the older method was insufficiently served by some half-a-dozen men.

It has been clearly established by all modern precedents that, in short day-to-day tours of a province, a motor vehicle is quicker and more efficient than the best of the older transports. For example, halts can be made at will by the side of grazing herds, diversions can be made on the spur of the moment, often without upsetting the dates of the tour programme ; in fact, by touring by car, a far more intimate knowledge of the country can be gained in less time and with less effort than by any other means. It follows also that live-stock improvement schemes operated by mechanized officers can be far more extensive and at the same time far better administered than under the old system.

There will be much reactionary criticism of these simple proposals. The old bogey of the absence of roads, except in certain deltaic tracts and mountain areas, is dead or dying, and the post-war road expansion will administer the *coup-de-grace* to this effete doctrine. The chief objection is, as usual, that of cost, but, after the wartime exhibition of conjuring currency from nowhere for schemes of destruction, it is clearly the duty of every able thinker to consider seriously ways of finding money for constructive work when peace returns.

## ARTIFICIAL INSEMINATION

ARTIFICIAL insemination proved a practical and efficient method for breeding nearly 2,000 range cows over a period of three years in the United States.

Of the cows inseminated one or more times, 78·8 per cent produced calves and required an average of 1·63 inseminations per calf. Study of the concentration, volume, and motility of the semen from twelve range bulls showed much variability, but, in general, fertility was related to semen volume, concentration of sperm, number of sperm per ejaculate, and percentage of live sperm. Through the use of stored semen and dilution, the number of cows bred with a single ejaculate was greatly increased. Uterine insemination gave the best results with about 200 cows, as contrasted with groups of twenty cows each inseminated by the cervical and vaginal methods.

Fertility below the average was obtained when less than 800,000,000 total sperm, or 275,000,000 live sperm or 175,000,000 sperm resistant to cold were employed for fertilization purposes.—*The Australian Dairy*, May 20, 1944.

# UTILIZATION OF INDIAN COTTON SEED

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IN the production of cotton seed India stands second in the world market, first being the United States of America. The average annual production of cotton seed in India is over 2,000,000 tons. The important cotton growing provinces and states arranged in order of their production of cotton seed are as under:

1. *Provinces:* Punjab, Central Provinces and Berar, Bombay, Madras, Sind and the United Provinces.
2. *States:* Hyderabad, Baroda, Punjab States, Bombay States, Central India States and Rajputana States.

Out of the provinces and states mentioned above, Madras, United Provinces and Rajputana states, however, do not produce sufficient quantity of cotton seed to satisfy their own requirements, and hence, they are required to import the seed from the neighbouring territories.

The export of cotton seed from India has dwindled from 197,193 tons in 1925-26 to a negligible amount in 1941-42 on account of the dirty condition and lower oil contents of the seed and general drop since 1928 in prices of oilseeds throughout the world markets. With the exception of 15 per cent cotton seed, i.e. 300,000 tons utilized for the production of oil and 200,000 tons used for sowing purposes, the whole crop is used as cattle feed.

### *Quality of Indian cotton seed*

The cotton seed produced in India is generally of a good quality. What is nesessary is to get the seed cleaned and graded into different varieties as it comes from the ginning factories before being stocked. In order to evaluate the different varieties of cotton seed produced in the country, 88 samples were collected from 10 cotton growing provinces and States and examined for moisture, husk, kernel, lint and oil content. The oil content of the seed varies from 11·0 to 22·5 per cent.

The cotton seed produced in India can thus be divided on the basis of oil content, into four classes as under.

| Class | No. of samples out of 88 which come under the class | Percentage of samples in the class |
|---|---|---|
| I. Oil content between 20·0–22·5 per cent | 22 | 25·0 |
| II. Oil content between 17·5–20·0 per cent | 43 | 48·9 |
| III. Oil content between 15·0–17·5 per cent | 18 | 20·4 |
| IV. Oil content below 15 per cent | 5 | 5·7 |

The distribution of important varieties of cotton seed produced in India under the classes mentioned above is as follows:

*Class I:*

| | | |
|---|---|---|
| Punjab | — | 4F, NR *desi*. |
| C.P. and Berar | — | Verum 262 and Roseum. |
| Bombay | — | Local Khandesh, 1027 A.L.F. Surat, and Gadag I. |
| Sind | — | N.R. |
| N.W.F.P. | — | Kohat Local. |
| Orissa | — | Local Gunupur. |
| Hyderabad | — | Peddapathi and Gaorani G6. |
| Baroda | — | Kadayo pure. |
| Gwalior | — | Combodia. |
| Indore | — | Combodia. |
| Mysore | — | M.A. II. |

*Class II:*

| | | |
|---|---|---|
| Punjab | — | 39 Mollisoni, 119 Sanguineum, 289F/K25 and LSS. |
| C.P. and Berar | — | Buri 107 and Amraoti mixed. |
| Bombay | — | Broach Local, Broath *desi* 8, Jarila, Khandesh, Jayawant, Wagad 8, Surti, Viramgaon Local, Wagad and Dharwad Local. |
| Madras | — | Cambodia 2, Westerns and Karun-Ganny. |
| Sind | — | 4F98 and Sind Sudhar. |
| U.P. | — | C 520 and *desi*. |
| N.W.F.P. | — | Dera-Ismail Khan Local and 4F acclimatized, Pishtakhara, Mardan, Sind Sudhar and 4F98. |
| Orissa | — | Aul. |
| Hyderabad | — | Chinapathi, Local, Warangal, Punas and Coconadas. |
| Baroda | — | B.D.8, Surtee Local Mathio and Kadayo-Mathio mixture. |
| Gwalior | — | Malvi. |
| Indore | — | Malvi mixed and Malvi 9. |
| Mysore | — | Nadam. |

*Class III :*

| | | |
|---|---|---|
| Punjab | — | 289F/43. |
| Bombay | — | Wagad Local. |
| U.P. | — | Perso-American and C 402. |
| Orissa | — | M.A. II, C.O.2, Bhadrak. |
| Assam | — | Nagahill. |
| N.W.F.P. | — | Bannu. |
| Hyderabad | — | Local (Karimnagar). |
| Gwalior | — | G.16. |
| Mysore | — | Sel 69 and H 190. |

*Class IV :*

| | | |
|---|---|---|
| Orissa | — | 4714 and A.I.S.A.2. |
| Bengal | — | 289F (Punjab). |
| Assam | — | Garohill. |
| Hyderabad | — | Jadi and Bani. |

It is interesting to note from the figures given above that nearly 75 per cent of the varieties of cotton seed (classes I and II) produced in the country give an oil content between 17·5 and 22·5 per cent. The seeds of these varieties can be advantageously used for the oil crushing industry. From the point of view of export trade also, seeds of these qualities would fetch a better price on the guarantee of oil content and refraction.

The average composition of Indian cotton seed obtained from the examination of samples is as under :

| | | |
|---|---|---|
| Moisture | — | 5·20 – 13·32 per cent |
| Husk | — | 37·00 – 54·00 ,, |
| Kernel | — | 32·25 – 52·70 ,, |
| Oil content | — | 11·00 – 22·50 ,, |
| Lint | — | 0·02 – 3·25 ,, |

### *Industrial utilization*

It is a huge economic loss to the country in allowing 1,500,000 tons of cotton seed to be used directly as cattle feed. When whole seed is fed to the cattle, a portion from 10 to 30 per cent is excreted undigested, depending upon the ration of the seed (ordinary quantity to heavy feed) and also on the age of the animal. Cotton seeds from ginning factories contain a large percentage of fibre on them which is injurious to animals as it causes serious digestive troubles. The most wholesome food for the cattle is decorticated cotton seed cake which contains about 7 per cent oil and is twice as rich in protein content as cotton seed.

In the oil crushing industry the following products are obtained from the cotton seed, which possess many industrial applications.

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| | Per cent | |
|---|---|---|
| Lint | 2·0 | Average yield |
| Husk | 40·0 | |
| Decorticated cake | 37·0 | |
| Refined oil | 13·0 | |
| Soap stock | 1·0 | |

Decorticated oil cake may be used for cattle feeding and other products can be utilized for industrial purposes as detailed below :

(1) Lint can be used for the manufacture of paper, artificial silk, celluloid articles, varnishes, etc.

(2) Husk may be used as fuel and for the manufacture of furfurol required in plastic industry. The fuel ashes are very rich in potash content and can be utilized as fertilizers as well as for the preparation of potassium salts.

(3) Refined cotton-seed oil is used for edible purposes and in the manufacture of vegetable product and margarine.

The quantity of 1,500,000 tons of cotton seed available in the country may be utilized in the following manner : (1) The low-oil-content seed, forming nearly 25 per cent of the quantity, i.e. 400,000 tons may be delinted and converted into meal for cattle feeding. (2) The major portion of the seed nearly 75 per cent, i.e. 1,100,000 tons can be used for oil milling and export purposes. In case 600,000 tons out of this quantity is utilized for oil milling, it would release the under-mentioned amounts of products other than oilcake for industrial uses.

| | | |
|---|---|---|
| Lint | — | 12,000 tons |
| Husk | — | 240,000 ,, |
| Oil | — | 78,000 ,, |
| Soap stock | — | 6,000 ,, |

### *Treatment of cotton seeds*

An ordinary oil mill equipped with expellers or hydraulic presses can be easily converted into a cotton seed crushing mill by providing the following equipment : (1) Seed cleaning machine. (2) Magnetic separator for the removal of small iron pieces mixed up with the seed from ginning factories. (3) Delinting machine for the removal of lint. (4) Decorticating machine for separating the husk from the kernel. (5) Brushing machine for the removal of fine particles of the kernel from the husk.

The oil obtained from the cotton seed is generally dark in colour and possesses high acid value. It is therefore necessary to refine it for edible purposes, and hence a refining, bleaching and deodorizing plant is also required for the oil mill. As the storage of raw oil develops acidity, it is advisable to refine it immediately after crushing to minimise the losses in refining.

### *Feeding properties of cotton seed and cake*

The question of feeding cattle on cotton seed and cotton-seed cake requires a very careful study and persistent action to eradicate the evil practices. Some of the important defects

of feeding cattle on cotton seed have already been pointed out. The feeding values of all the cotton seed products have been examined. The results are given in the following Table :

| Chemical constants | Cotton seed percentage | Undecorticated cake from ginned seed percentage | Undecorticated cake from defibrated seeds percentage | Decorticated cotton seed cake percentage |
|---|---|---|---|---|
| Moisture | 8·00 | 13·75 | 11·20 | 10·40 |
| Proteins | 22·40 | 24·60 | 25·00 | 42·37 |
| Fat | 19·20 | 6·56 | 7·20 | 7·10 |
| Carbohydrates (by difference) | 27·40 | 29·30 | 30·10 | 25·80 |
| Crude fibre | 18·90 | 21·20 | 21·00 | 7·10 |
| Ash | 4·10 | 4·60 | 5·50 | 7·00 |

It is evident from the figures given above that decorticated cotton-seed cake (from the nutritive point of view) is nearly twice as rich in protein content as cotton seed. Undecorticated cake from ginned cotton seed is also injurious on account of the large percentage of fibre. The cake from undecorticated and defibrated seed can be used without much objection, as it is free from cotton lint, but its protein content is low. It will therefore be necessary to use larger quantities of this cake in order to make it as efficient as decorticated cake.

The use of cotton seed for direct feeding has long been in practice, and hence it requires persistent efforts to persuade people to discontinue the practice which is neither economical nor beneficial.

It is necessary to develop the cotton seed crushing industry for the supply of cake to foster the propaganda for replacing the seed in animal feed by the cake.

## *Conclusion*

It is encouraging to note that cotton seed crushing is slowly gaining ground in India. There was only one mill in the country until 1937, but now there are two big mills crushing about 100,000 tons of seed per annum. In addition to these mills, there are over a dozen medium size oil mills crushing over 100,000 tons of cotton seed in the Punjab and the requirement of cotton seed for small oil mills in India may be estimated at 100,000 tons annually.

The total quantity of seed crushed for the production of oil is over 300,000 tons, which is nearly 15 per cent of the total production of cotton seed in India.

It is evident that there is a very big scope for the development of this industry and a beginning can be made in the important cotton growing provinces and States of India. There are good prospects for developing cotton seed crushing in Khandesh, Bombay, Central Provinces and Berar, Hyderabad and Baroda as the manufacture of vegetable ghee is increasing in these localities.

# FISH FILLET INDUSTRY IN INDIA

By K. Gopinath

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FRESH water fisheries in India are poorly developed and do not form adequate sources of fish supply and there are many virgin grounds still to be exploited. At present some of the important inland towns in India depend for their fish supply on the sea, and even in Bengal where fresh water fisheries have been developed to a remarkable extent, marine fish constitute a good proportion of the total supply of fish to various markets. It is well known that successful and constant supply of fish, both fresh and preserved, to various towns depends on an efficient system of transport, which even now is undeveloped and un-co-ordinated to cope with the ever-increasing demand for fish. Introduction of motor boats or steam launches for carrying fish from the various fishing centres to markets in Bombay and Calcutta in recent years has considerably augmented the supply of fish to these places. But in Madras and along the west coast of Malabar and Travancore, where power vessels have not yet been introduced, fish is transported by rail, motor lorries and even by country carts. For transporting fish into the interior parts of the country the conveyances generally used in all parts are trains and motor lorries.

## *Three types*

The fish supplied to various markets is mainly of three types, viz. fresh fish, fish packed in ice or frozen and cured fish. Fresh fish owing to the impracticability of transporting them to distant places find only a local market, whereas most of the fish transported to various important inland markets fall under the second and third categories. Fish from the fishing grounds, when taken to markets in power launches, are stored in their holds with crushed ice, after gutting and washing. For distribution into inland markets, fish are packed in layers with alternating layers of crushed ice in deal wood boxes, while frozen fish from the cold storage at Trivandrum are transported in special insulated boxes capable of holding fish in good condition for a period of about three to four days. Cured fish are usually transported in the crudest possible manner, being commonly packed in palmerah leaf bundles and sometimes in barrels and on rare occasions in wooden boxes.

Considering the conveyances used for the transport of fish in India and also the methods of handling and packing, one can easily understand the handicaps of the present day fish trade. In the first instance, fish packed in ice are often only gutted and washed, while in curing they are also split longitudinally and the head, vertebral column, other bones and the fins, which are mere waste, are retained. Although the percentage weight of offal in various Indian fishes have not been calculated, investigations carried out elsewhere have shown that with ordinary fishes 42 to 65 per cent of the live-weight is composed of waste matter. It is evident, therefore, that according to the present custom a good deal of waste matter is being included in consignments and that the extra cost of transportation is ultimately borne by the consumer. Besides, it is well known that fish transported in bulk are liable to rapid decomposition. The soft parts of the body such as the viscera and the gills are points where putrefaction first sets in and regions adjoining these are affected immediately after. In the case of fish packed in ice, (owing to insufficient ice and imperfect packing) the portions adjoining the soft parts ordinarily become spoiled in transit and the fish arrive in markets in a state of partial decomposition. In the case of dried fish the vertebral column and other bones form centres of attack by certain acarid parasites. Such spoiled fish, owing to their inferior quality, may force the merchant to sell them at a knock-out price and though the merchant and middlemen are not affected by this procedure, it will have its repercussions on the poor fishermen as well as the consumers.

## *Filleting in other countries*

The fish trade in foreign countries was faced with similar handicaps at one time in its history, but careful investigations and adoption of improved marketing methods have overcome these difficulties. In order to economize transport and also to increase the consumption of fish by better presentation, fillet trade was first adopted by the United States of America and was

subsequently followed by the United Kingdom and some European countries. Filleting means cutting the fish into strips of convenient sizes to suit the capacity of the containers and also to the whims of the retailers and the consumers. The fillets represent the two halves of the flesh of the fish without bones, fins and skull. Filleting is usually done with or without the skin. The fillets are preserved according to all known methods of preservation such as ice packing—in which case they are first wrapped in parchment or vegetable tissue paper—, refrigeration, salting and smoking, sun drying or even pickling. In the United States of America, fillets are first wrapped up in parchment paper bearing the name and trade mark of the firm and then placed in cylindrical tinplate containers of 20 kilogramme capacity. The containers are then packed in rectangular wooden boxes and the interspace filled with crushed ice. For exporting to distant places, the fillets are slightly smoked or rinsed in pickle and the whole packet placed in cold chamber for some time. A more or less similar method is used in the United Kingdom and other European countries. But in the U.S.A. for distribution to places of easy reach, the fillets are wrapped up in parchment and then simply packed in deal wood boxes containing crushed ice.

## *Advantages and disadvantages*

Such a trade in India may have certain disadvantages. The first is the increased labour and the consequent expense for filleting. But if there are increased expenses, there is a proportionate reduction in the transport charges so that the ultimate expenditure may remain the same. The second and the more serious disadvantage is the possibility of placing in the markets inferior and spurious stuffs. This may be overcome by an efficient system of inspection and control, whereby each variety or grade of fish may be certified on each packet. The third difficulty brought about by the present emergency conditions is the scarcity of paper for wrapping purposes. And then, of course, the present transport difficulties. It may be mentioned here that recently in this State an attempt has been made, with some success, to print handbills on semi-dried plantain leaf. Similarly investigations may be carried on to see whether semi-dried and sterilized plantain leaf or any other thin leaf can be used as wrapper for fillets. Use of plantain and other leaves for wrapping is not new to this country and an increased use of these may mean the encouragement of another cottage industry.

In contrast to these, the advantages are manifold and introduction of this trade in India, though not on such an elaborate scale as in the U.S.A., seems to be very desirable under the present conditions. The following are a few of the important advantages:

*Economy in transport:* By converting fish into fillets, both the volume and the weight are reduced, thereby facilitating accommodation of the maximum quantity in the minimum space and reducing the cost of transport considerably. Thus, we may be able to pack the fillets of three fishes in the space required by one whole fish, with a corresponding decrease in the cost of transport. Fishes too big and unwieldy for easy transport could be conveniently converted into fillets.

*Prevention of decomposition:* In filleting, the vertebral column and other bones are removed and thus there is no possibility of attack by acarid parasites. Fillets packed in ice, especially those prepared from regions farther away from the soft parts may remain in a perfect condition for a longer period thus ensuring better quality of the product. Preserved according to any well-known method of preservation and packed in suitable containers, such fillets may keep for a considerable length of time.

*Preparation of fish meal and manure:* Large quantities of waste matter in the shape of heads, bones and fins are produced during filleting and these could be usefully converted into fish meal. The importance of fish meal as a feeding stuff for livestock has not yet been fully realized in India. As a matter of fact, even in foreign countries experiments were made with it only about half a century ago, and tests showed that the value of fish residues for livestock was much greater than was ever imagined. The two chief constituents of fish meal are proteins and mineral substances which together constitute more than three-fourths of the fish. If properly prepared, its food value is enhanced by the greater extent to which the nutritive constituents can be digested. The only care to be taken is to reduce the oil contents of the meal to the required percentage suitable for animal feeding, i.e. below 5 per cent. This country is in need of feeding stuffs and the by-product of the fillet industry may help to solve this deficiency to an appreciable extent. Offal unfit for meal preparation can be utilized for the preparation of fish manure which contains about 7 to 9 per cent nitrogen, 3 to 8 per cent

phosphoric acid and 1 per cent potash, and is one of the best known fertilizers.

*Better presentation and ease in cooking:* Window dressing or display has become an art now and it plays an important part in promoting industries. Experience shows that it is the presentation of the material which counts much with the customers. Much attention is paid to display of fish on marble tables and in glass cases in most of the European countries. Many people in this country, who have no aversion to the use of fish, refrain from purchasing it owing to the labour involved in cleaning and gutting and the disagreeable smell which the process involves. For those living in cities, the disposal of fish waste is another serious problem. Again, a city housewife would like more of ease and leisure in cooking and so would prefer ready-made materials. The present day manufacturers have perceived this demand so well that it is now possible to provide a full course dinner direct from tins and bottles. Freshly prepared fillets of fish attractively packed have a better appeal than the whole fish and meet with a better reception from the public.

India at present is faced with a serious food shortage and the Central Government are endeavouring hard to increase food production with a view to making this country self sufficient. Concurrent with this, the Imperial Council of Agricultural Research and other allied bodies in India are putting in efforts to increase the output of fish and to improve the existing methods of preservation. But it goes without saying that any scheme for procurement, preservation and distribution of fish can only be successful if a co-ordinated system of transport is available. At present when transport facilities are very limited and containers scarce, the key note of every industry should be economy. The endeavour should be to pack and transport the maximum quantity in the minimum available space. We now know that in order to facilitate transport eggs are being dehydrated and powdered, and essences of various materials prepared as substitutes for the raw product.

As far as fishery products are concerned, the only products so far placed in the market satisfying the above conditions are the 'powdered prawns' prepared according to a process perfected by this Department, also that unique product called *masi* imported from the Laccadive and Maldive Islands and the semi-dried prawns prepared by the Madras Government Experimental Station at Thanur.

Though isolated instances of filleting are known to exist in some parts of India, so far no regular attempt has been made to establish this industry on a commercial basis. Introduction of fillet industry will be very timely under the present conditions and will be a blessing both to the public and the poor fishermen. Tunnies, seerfishes, pomfrets and other varieties of the bigger fish are considered best for filleting by the fishermen in this State. Excepting sardines, anchovies, white-baits, silver-bellies and other varieties of the smaller and thinner fish most of the so-called round fishes are suitable for filleting. Fish with coarse textures and others at present not in high favour, if filleted may find better markets and higher prices.

# APPLE HAIRY CATERPILLAR IN THE SIMLA HILLS

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and

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In July 1940 some apple plants in Gopalpur village in the Kotgarh *ilaqa* (Simla Hills) were found completely defoliated. In spite of a thorough search, the insect responsible for this damage could not be found anywhere near. The orchard was kept under constant observation and our vigilance was ultimately rewarded by the discovery of some egg-masses covered with yellowish brown hairs (like those of the notorious gypsy-moth of America). They were embedded in the joints and crevices of the stone walls surrounding the orchard. These eggs were transferred to the laboratory at Kotgarh. They hatched on 22 March, 1941 and the adults which emerged in due course were identified as *Lymantria obfuscata*, Wlk. by a systematist of the Imperial Agricultural Research Institute, New Delhi.

## Distribution

*L. obfuscata* occurs as a pest in Aina, Himtala, Kotgarh proper, Losnta, Pomlai, Rhoga and Thanedar in the Kotgarh *ilaqa* and Kaithu and Summer Hill in Simla. We also collected the same from a village called Ani in the Kulu sub-division in June, 1941. Outside the Punjab this pest occurs in Kashmir.

In addition to apple (which is decidedly its most preferred host plant) the pest has also been recorded as feeding on 'maru' (*Quercus diltata* Kitch.), a forest plant which grows commonly in the Kotgarh *ilaqa*. Beeson[1] records its doing damage to alder, while Fletcher[2] to apricot, poplar and willow.

## Description of various stages

*Egg :* Shining light greyish brown in colour and round in shape with a depression at either extremity.

*Larva :* A full-grown larva clothed in tufts of hair is described fully by Gardener (1938 : *Indian Forest Record*, Ent. III, 10).

*Pupa:* Length 17-20 mm., breadth 5 to 7 mm. Body smooth, brown to dark reddish brown in colour. It bears a distinct and well-developed cremaster which bears numerous hooks on it.

*Adult :* Adults are described by Hampson (1892 : *Fauna British Moths* I : 460-464). Female is incapable of flight, its wings being feebly developed.

## Life history

The adults appear on the wing about the middle of June. They remain active up to the middle of July after which they perish. In captivity a male moth lives for 4 to 7, and a female for 11 to 31 days. The female moth has a heavy body and weak wings and is incapable of sustained flight ; it crawls or just flutters along on the ground. The male moth, on the other hand, has a light body and well-developed wings and is a strong flier.

*Mating :* The male flies to the female for mating. This lasts for 1 to 2½ hours as shown in the table below :

Table I

Showing duration of mating period in *L. obfuscata* Wlk. at Kotgarh

| Pair number | Mating started | Mating ceased | Duration of mating period (hours) |
|---|---|---|---|
| 1 | 6·0 p.m. | 8·30 p.m. | 2·30 |
| 2 | 4·45 „ | 6·0 „ | 1·15 |
| 3 | 2·12 „ | 3·55 „ | 1·47 |
| 4 | 6·15 „ | 8·5 „ | 1·50 |
| 5 | 6·31 „ | 8·25 „ | 1·54 |
| 6 | 6·7 „ | 7·25 „ | 1·18 |
| 7 | 4·5 „ | 6·12 „ | 2·7 |

It was observed that a male moth could successfully fertilize at least three females in its life time.

*Preoviposition period :* Preoviposition period varied from 45 minutes to 6 hours 35 minutes in the laboratory at Kotgarh as shown in Table II.

[1] *Forest Insects*, p. 39, 1941

[2] Report of proceedings—Third Entomological Meeting 1919, p. 90.

TABLE II

Showing preoviposition period of *L. obfuscata* Wlk. at Kotgarh

| Pair number | Mating ceased at | Oviposition started at | Duration of pre-oviposition period (Hours) |
|---|---|---|---|
| 1 | 8·30 p.m. | 11·0 p.m. | 2·30 |
| 2 | 6·0 „ | 9·15 „ | 3·15 |
| 3 | 3·55 „ | 9·5 „ | 5·10 |
| 4 | 8·5 „ | 12·30 „ | 4·25 |
| 5 | 8·25 „ | 9·10 „ | 0·45 |
| 6 | 7·25 „ | 2·0 „ | 6·35 |
| 7 | 6 12 „ | 8·18 „ | 2·6 |

*Oviposition :* Females lay eggs (1) in joints and crevices in the stone walls, (2) in cavities and holes in the mud walls, (3) on logs and stones near about infested plants, and (4) under bark of the tree. During oviposition a female does not move about at all but remains confined to the spot where she is depositing the eggs. A female is capable of laying 200 to 400 eggs in its lifetime. They are laid by instalments in a single, big cluster, a female taking 4 to 6 days to complete the operation. A female covers with yellowish brown hairs first each batch of eggs, and ultimately the whole cluster. After laying its egg-cluster it lives for 15 to 20 days during which period it does not move about much, but remains near about the egg-cluster.

*Duration of egg stage :* It will be seen from the table III given below that the egg-stage of this pest occupies a period of about 8 to 9 months.

TABLE III

Showing duration of the egg stage of *L. obfuscata* Wlk. at Kotgarh

| Eggs laid on | Eggs hatched on | *Duration of egg stage* months | days |
|---|---|---|---|
| 23.6.1941 | 22.3.1942 | 9 | 23 |
| 30.6. „ | 22.3. „ | 8 | 23 |
| 5.7. „ | 22.3. „ | 8 | 17 |
| 26.6.1942 | 23.3.1943 | 8 | 27 |
| 4.7. „ | 23.3. „ | 8 | 19 |
| 12.7. „ | 23.3. „ | 8 | 11 |

*Duration of larval stage :* Table IV below gives the duration of the larval stage at Kotgarh.

TABLE IV

Showing duration of larval stage of *L. obfuscata* Wlk. at Kotgarh

| Eggs hatched on | Larvae pupated on | Duration of larval stage (days) |
|---|---|---|
| 22.3.1941 | 27.5.1941 | 66 |
| 22.3. „ | 9.6. „ | 79 |
| 22.3. „ | 22.6. „ | 92 |
| 22.3.1942 | 1.6.1942 | 71 |
| 22.3. „ | 12.6. „ | 83 |
| 22.3. „ | 25.6. „ | 96 |
| 22.3.1943 | 10.6.1943 | 79 |
| 22.3. „ | 21.6. „ | 90 |
| 22.3. „ | 1.7. „ | 100 |

Thus the larval stage is completed in 66 to 100 days. For pupation the caterpillar crawls to a sheltered spot away from the plant on which it fed and spins an oval, light brown, ¾ in. long cocoon made of compactly woven silken threads.

*Duration of pupal stage :* Table V below gives the duration of the pupal stage.

TABLE V

| Larvae pupated on | Moths emerged on | Duration of pupal stage (days) |
|---|---|---|
| 27.5.1941 | 10.6.1941 | 14 |
| 2.6. „ | 23.6. „ | 21 |
| 19.6. „ | 28.6. „ | 9 |
| 1.6.1942 | 17.6.1942 | 16 |
| 13.6. „ | 1.7. „ | 18 |
| 25.6. „ | 10.7. „ | 15 |
| 10.6.1943 | 30.6.1943 | 20 |
| 22.6. „ | 6.7. „ | 14 |
| 1.7. „ | 13.7. „ | 12 |

It is seen from the above table that the pupal stage is completed in 9 to 21 days.

*Proportion of sexes :* Table VI below gives the percentage of sexes of the moths which emerged in the laboratory during 1941-1943.

TABLE VI

| Year | Percentage of males | Percentage of females |
|---|---|---|
| 1941 | 69·2 | 30·8 |
| 1942 | 69·2 | 30·8 |
| 1943 | 69·6 | 30·4 |

It will be observed from the above table that males and females were in proportion of about 2 to 1.

*Life-cycle :* Table VII below gives duration of life-cycle.

TABLE VII

| Eggs laid on | Eggs hatched on | Larvae pupated on | Adults emerged on | Duration of total life-cycle | |
|---|---|---|---|---|---|
| 2 | | | | Months | days |
| 3.6.1941 | 22.3.1942 | 1.6.1942 | 17.6.1942 | 11 | 24 |
| 3 0.6. „ | 22.3. „ | 16.6. „ | 28.6. „ | 11 | 28 |
| 5.7. „ | 22.3. „ | 23.6. „ | 5.7. „ | 12 | 0 |
| 2 6.6.1942 | 23.3.1943 | 10.6.1943 | 30.6.1943 | 12 | 4 |
| 6.7. „ | 23.3. „ | 20.6. „ | 6.7. „ | 12 | 0 |
| 2.7. „ | 23.3. „ | 29.6. „ | 12.7. „ | 12 | 0 |

*Seasonal history:* The pest has only one generation in a year at Kotgarh.

The adults are active during June-July when they lay eggs. After remaining in the egg-stage for 8 to 9 months they hatch in the beginning of the fourth week of March (Table III). The caterpillars appear at the end of March to end of June while the pupae are met with from beginning of June to the middle of July.

### Nature and extent of damage

The pest may infest 20 to 25 per cent of apple trees in an orchard. The larvae are gregarious and feed only at night. During daytime they hide in the loose soil round about the bases of infested plants, from where they come out at night, climb a plant and feed on leaves. If an artificial light is brought near the trees on which these caterpillars are present they at once stop feeding, climb down to the loose soil to hide. If left undisturbed they feed on the plant till dawn when they leave it to hide in the soil. It is due to this habit of the pest that it generally remains undetected. But if infestation is serious a few larvae may linger on the plants attacked during day time and thus reveal their identity.

The newly hatched young larvae feed on tender leaves. Their appetite increases with age. They eat up the entire leaf lamina leaving only the harder veins behind it. The attacked plant, which is usually completely defoliated, does not bear any fruit.

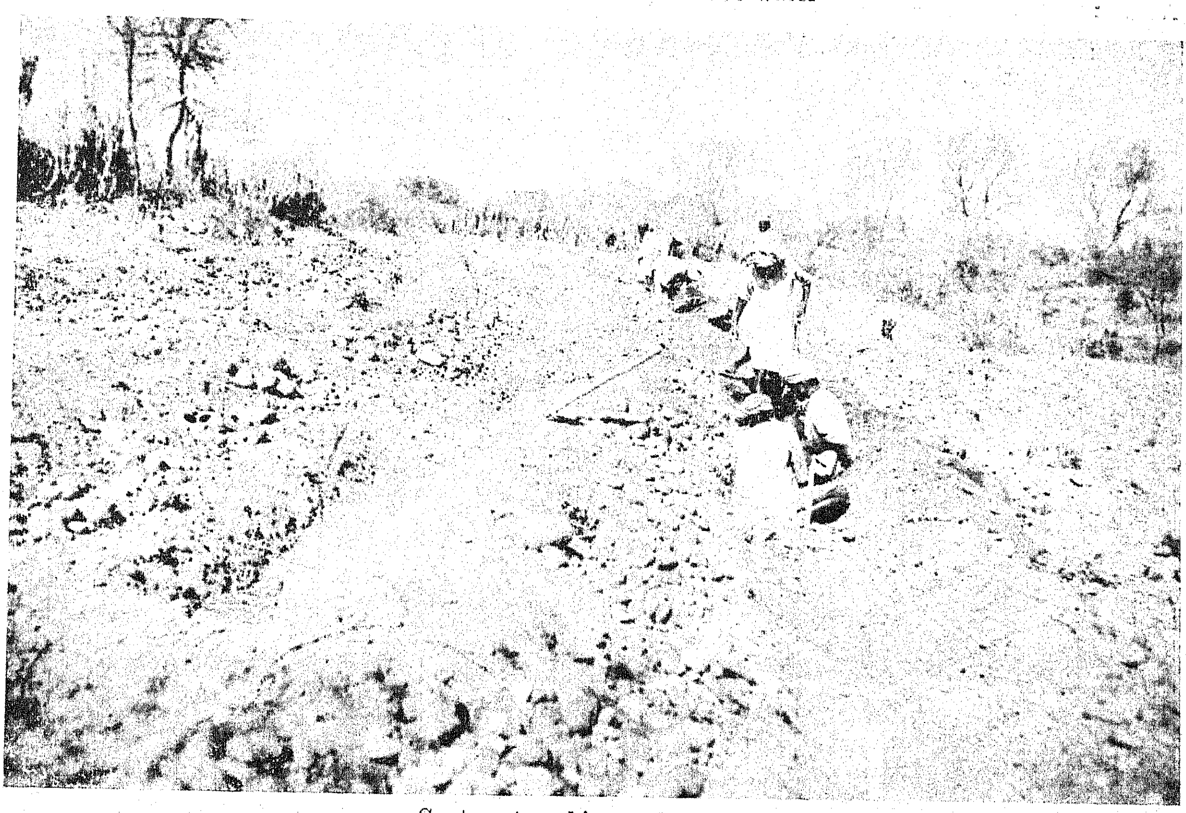
### Control methods

1. As already pointed out the egg-clusters of the pest are covered with yellowish brown hairs. This makes them fairly conspicuous on the substratum on which they are deposited. They should be searched out regularly between August and March and destroyed.

2. To deal with the caterpillars effectively, soil round about the bases of infested plants should be consolidated and flat pieces of stones should be scattered over so as to serve as hiding places. The caterpillars settle in scores on the under side of these flat stones during the day and they can be killed by dropping the stones in water having a film of kerosene oil spread on its surface.

3. To prevent the caterpillars from climbing apple plants a 4 in. wide strip of oiled cloth should be tied round their stems during the daytime, taking care that no openings are left beneath it i.e. the strip. These strips should be renewed after every two weeks or earlier if the rains have been heavy and frequent, during March to June.

To prevent erosion and to conserve water



Contour-trenching and bunding

PLATE 30

Above : The Rabaries—Credit for survival of Kankrej cattle goes to this community.

Below : A herd of Rabari cows. Hundreds of such herds move every year from place to place in search of grazing.

[*See page* 315

# NOMADIC CATTLE BREEDERS OF GUJERAT AND KATHIAWAR—I

By B. B. MUNDHE, G.B.V.C., DR. MED. VET. (MUNICH)
*Deputy Director of Veterinary and Animal Husbandry Services, Baroda State*

LIVESTOCK breeding in Gujerat and Kathiawar can be broadly classified under two systems : the stable and the nomadic. The former is followed by the stabilized land-holding or agricultural classes and the latter by those who possess no land but only big herds of cattle with which they wander about in places where good grazing is found. The stable or agricultural class, does not keep all sorts of animals: they usually restrict their livestock to a pair of bullocks and a buffalo or two. The nomadic class of breeders, with some exceptions in Kathiawar or southern Gujerat, keep the breeding stock. This division of cattle-breeding has consequently made the stable breeder dependent on nomadic breeders for bullocks for agricultural work.

In so far as Gujerat and especially central Gujerat is concerned, one may suggest the following reasons for this strict division in cattle breeding :

(1) Small holdings, (2) intensive cultivation concentrating attention on cash crops such as cotton and consequent paucity of fodder production, (3) religious objections to castration of homebred bull calves, (4) availability of working bullocks from nomadic traders and breeders, (5) lack of grazing areas, (6) better returns from buffaloes, and (7) the adaptability and docile nature of the buffalo in contrast to the cow.

Thus the nomadic breeder has become a necessary evil. He was a beneficial and complementary factor in the agrarian economy of Gujerat in the past, when unoccupied areas in and around the intensively cultivated and densely populated tracts were ample ; but he has become an intolerable evil and a menace to cultivators at present due to the reduction of these areas, which were formerly used by breeders for grazing their herds at practically no cost.

The problem of the nomadic breeder has therefore become very acute in Gujerat and warrants special consideration, as it is becoming more and more serious every day.

## Nomadic breeding communities

The communities associated with nomadic livestock breeding are mainly : (1) the Rabaris, (2) the Bharwads, (3) the Maldharis (4) the Ahirs and (5) the Charans. The last three of these are found mostly in Kathiawar and the first two both in Gujerat and Kathiawar.

(1) The *Rabaris* are the main cattle-breeding community in Gujerat and about 95 per cent of cows in northern and central Gujerat belong to this community. The cow has survived in Gujerat because of this community and the credit for preservation of the good Kankrej breed goes to them.

(2) The *Bharwads :* This community is identical with the Vanzaras in the Deccan and is found all over Gujerat and Kathiawar. A few of them keep cattle, but the majority have taken to sheep-and goat-rearing. They also claim to have come originally from areas round about Muttra and Brindavan.

(3) The *Maldharis*, *Ahirs* and *Charans* are found mostly in Kathiawar, especially in tracts round about the Gir forest. They keep herds of cows and buffaloes, and credit for preserving good strains of Gir cows and Jafarabadi buffaloes must go to them.

## Past and present

All the above-mentioned classes of breeders are socially separate communal entities and have been traditional livestock breeders for ages. The real credit for improvement and preservation of good strains of cattle, sheep and goats and even buffaloes (especially in Kathiawar) must go to them. They make very good controllers and judges of cattle. They have their traditional ideas and conventions about the good and bad points of cattle and about their raising. Some of them possess good knowledge of veterinary medicine (old system) and others are expert in dealing with obstetric cases.

Although the chief source of livelihood to all the nomadic breeders is livestock, practically none of them have any land of their own either to graze the cattle or to produce fodder crops wherewith they can maintain their stock. They flourished so far by grazing their cattle in unoccupied areas which used to be ample and cost them nothing. They earned their

living partly from milk products and partly from the sale of the bull-calves to the cultivators.

It would not be wrong to say that nomadic cattle-breeding in Gujerat was engendered by peculiar religious customs and susceptibilities. Gujerat and Kathiawar came under the virile influence of Jainism and are still the strongholds of orthodox Jainism. Destruction of and causing harm to animal life or its emasculation are tabooed in Jainism, and to counteract the increasing influence of Jainism, the Hindu sect also accepted the *ahimsa* principle and tabooed castrations and such other practices causing pain to a living creature. That accounts for the many *pinjrapoles* and *gawshalas* to be found in Gujerat and Kathiawar and, also, for castration being held in abhorrence by caste Hindus. Many people in Kathiawar use their uncastrated home-bred bulls for work or sell the home-bred bull-calves and purchase castrated ones, not infrequently the same animals as were sold in uncastrated condition. They naturally have to sell low and purchase high for the consolation of having acted according to religious convictions.

So there are no patrons of the cow in Gujerat except the Rabari and the *pinjrapoles*. The latter have to be ruled out from the field of constructive work, due to their incurable orthodoxy and consequent inability to render real service to the livestock economics under present conditions. The Rabari, as a keeper of the cow and producer of working bullocks has, therefore, a legitimate place in the agrarian economics of Gujerat, unless the tiller of the soil takes to cattle breeding and alters his views in regard to castration.

The present conditions, however, do not enable the cultivator to become a patron of the cow, nor do the existing grazing areas enable the Rabari to tend his cattle as in the good old days. The demand for foodgrains and raw materials of the increased population and for commercial and industrial activities must be met and more and more land must be brought under the plough reducing the unoccupied grazing areas as a natural consequence. Judging from the statistics of Baroda State alone, one finds that only 48 per cent of the total area was occupied in 1881 which increased to 75 per cent by 1942. The percentage of cultivated area to cultivable area for the respective years was 81 and 96 respectively. This expansion in cultivation, especially of cash crops has, however, reacted adversely on the profession and the economics of the community pursuing cattle-breeding on the ranch system. Deprived of free and ample grazing of unoccupied areas, the breeders began to encroach upon the crops of the stabilized cultivators. Thus ensued conflicts between the breeders of stock and the tillers of soil causing disharmony between the two classes, so much so that the Government had to frame laws protecting the interests of the peace-loving cultivator. These restraining steps, unaccompanied by any ameliorative measures, however, resulted in the deterioration of the cattle population, thus enhancing poverty of the breeders and developing criminal proclivities amongst them. The breeders of the stock and the tillers of the soil began to look upon each other as enemies so that the Rabari is now considered a pest and social enemy No. 1 of the cultivator.

The extent of harm done to the cattle-breeding industry on account of scarcity of grazing may be seen from the table given below :

| Items of comparison | Conditions about 50 years ago | Conditions at present |
|---|---|---|
| Families of Rabaris engaged in cattle breeding industry | 100 per cent | 60 per cent |
| Average strength of cattle herds of each family | 15 to 30 | 6 to 15 |
| Age of first calving | $2\frac{1}{2}$ to $3\frac{1}{2}$ years | 4 to 6 years |
| Calving interval | 15 to 18 months | 18 to 36 months |
| Average daily milk yield per cow during lactation | 8 lb. | Hardly 3 lb. |
| Length of lactation | 9 to 12 months | 4 to 6 months |
| Average No. of calves during the life-time of a cow | 6 to 8 | 2 to 4 |

The above figures have been worked out after enquiries from several Rabaris in Mehsana district. These indicate a serious deterioration in cattle of the Rabaris and its possible influence on the national economy. As the degeneration of cattle, if allowed to continue unheeded, will cause scarcity of working bullocks, thus threatening agrarian economics as well as social and communal harmony, the problem of nomadic breeders must be studied and solved.

### *Problem of nomadic breeders*

The main problem of the Rabari and other communities is want of sufficient fodder for

their cattle ; but the provision of that alone would not meet the situation, nor would modern ideas and conditions permit us to offer the Rabaris all that they might think necessary in terms of their own conventions and convictions.

A radical change of outlook to suit the present conditions is necessary and the whole system of cattle-breeding has to be overhauled. There are two aspects of the problem to be considered, (1) whether resources are available and if so to what extent ; and (2) what and how adjustments can be made in the industry to meet the new situation.

The Rabaris thus labour under certain advantages as well as disadvantages. The advantages are their possession of cows and of some knowledge of cattle breeding. The disadvantages are as follows: (i) Want of land of their own to maintain their cattle on. (ii) Lack of financial resources to purchase land or feeding stuffs. (iii) Want of adaptability to changing conditions. (iv) Want of education and sense of responsibility.

The Rabaris think that cattle must be raised on the free spoils of nature and on extensive areas at their free will and not on grass produced by man even in limited areas. This mentality has to be changed. The problem thus has two aspects, (i) material as well as (ii) cultural. The Baroda State has already put in a scheme to tackle this intriguing problem.

## PREPARING THE COW FOR MILKING

'LETTING DOWN' of milk is the result of a positive act causing tiny mucsle cells to contract thus squeezing the milk out of the alveoli where it is made. This is a reflex act, spontaneous to a stimulus, which causes the pituitary gland to secrete a hormone (oxytocin) into the blood by which it is carried to the mammary gland.

The following fundamentals about the response and action of this reflex furnish the basis for several recommended practices: 1. Response to the stimulus is interfered with by any condition that distracts the cow. 2. Once the 'let down' has occurred, it is effective for but a short period of time. 3. Cows may become conditioned to let down their milk to a number of different stimuli. 4. The way a cow responds to milking is determined largely by training. 5. About 45 seconds are required from the application of the stimulus to the 'let down' of the milk.

The following 11 rules are based on these fundamentals : 1. Handle heifers carefully when they are first milked. 2. Avoid the unusual during milking. 3. Do not treat the cow roughly at any time. 4. The milker must be a person who does not arouse the cow's suspicion. 5. Do not wash or massage the udders or stimulate cows in other ways to let down their milk before milking is to begin. 6. Milk those cows first which let down their milk in response to preparations for milking. 7. Milk rapidly. 8. Do not practice prolonged stripping. 9. Operate milking machines according to the manufacturers' directions. 10. Do not leave the milking machine on the cow after the milk has ceased flowing. 11. Develop the technique of knowing by feel when the gland has been emptied of milk.—*Journal of Dairy Science*, May, 1944.

# LYMPHANGITIS IN THE HORSE

By P. R. Krishna Iyer

*Research Officer, Imperial Veterinary Research Institute, Izatnagar*

LYMPHANGITIS is a condition in horses in which swelling of the limbs occurs due to inflammation of the lymph vessels and the surrounding tissues. Non-specific lymphangitis, popularly known as 'weed' or 'Monday morning disease' is a condition occasionally seen in horses fed on a high protein diet during a short period of rest from hard work. All other forms of lymphangitis are caused by infection from superficial wounds or abrasions. There are three main forms of this type of lymphangitis (a) one which accompanies the disease known as glanders, (b) a form known as 'ulcerative lymphangitis' and (c) the disease called 'epizootic lymphangitis', which is a more serious condition, caused by a fungus. For some unknown reason, all these diseases more frequently involve the hind limbs, and horses of all ages and breeds are apt to be affected.

## *Epizootic lymphangitis*

This disease is essentially chronic in its course and is prevalent throughout Asia. The organism is a strict tissue parasite, and infection is carried directly from diseased to healthy horses. This fact facilitates control of the disease, as the immediate isolation of all infected animals and the proper treatment of all those with wounds and abrasions, especially around the feet, has a limiting effect on the spread of infection. It is also possible that flies mechanically transmit the disease, and therefore the control of these pests is a further step in minimizing the incidence.

*Symptoms:* The incubation period of the disease, i.e. the time between infection and the appearance of symptoms, averages six to eight weeks, but is sometimes much longer. The first noticeable symptom is the presence of small swellings along the course of a superficial lymph vessel of the lower limb, and it may be that a persistent wound or a scar indicates the point of entry of the infection. As the disease progresses, the infection spreads to the deeper lymph vessels which stand out prominently. A little later, a diffuse swelling of the part is seen, and slowly the whole limb becomes involved. The lymph glands, into which the lymph vessels drain, become markedly swollen and rupture, discharging a thick creamy pus rich in organisms. Similarly pus formation takes place in the nodes along the course of the lymphatics. Healing of these lesions is slow, and treatment usually disappointing. Sometimes, an apparent cure is followed by recurrence. The ulcers, which are left after the evacuation of the pus, slowly fill up with unhealthy-looking 'proud flesh' which overhangs the edges of the ulcer. The infection frequently spreads from the limb to other skin areas of the body by way of the lymphatics.

Sometimes lesions are noticed on the lips, nasal and vaginal mucous membranes and in the lungs (but rarely) and the intestines. The disease is non-febrile, and in the early stages the animal's general health remains unimpaired, although emaciation and debility set in. A fatal outcome is exceptional, although in Great Britain animals affected with the disease must be destroyed under the Epizootic Lymphangitis Order of 1905. Carcases must be properly disposed of, and very close inspection of all in-contacts is necessary for some months. Infected stables must be evacuated and disinfected and not used again until a lapse of six months. All harness, grooming tools, clothing etc. of the infected horse should be burnt.

## *Ulcerative lymphangitis*

This disease bears some superficial resemblance to Epizootic Lymphangitis. It is very contagious, the donkey being particularly susceptible. Very little is known of this disease in India, although sporadic cases have been encountered in *tonga* ponies, especially those kept under unhygienic conditions. The causative organisms gain access through abrasions and wounds in the region of the heel or fetlock.

*Symptoms:* The onset of the disease is sudden, the first symptom being pain and swelling around the fetlock with moderate fever. Small skin swellings appear which ripen and burst, yielding a purulent blood-stained discharge and leaving irregular ulcers with eroded edges. The ulcers usually heal within two to three weeks, and the

resulting scar is fairly typical in appearance. Usually, a second crop of ulcers forms, and in this way large areas of the skin may become involved. The disease, in its mild form, does not, as a rule, extend above the hock joint, but in more severe cases the infection spreads deeply into the underlying tissues of the limb, involving the lymphatic vessels, and even tendons and joints. This form is attended with high fever. The infection may spread rapidly to the lungs and other internal organs and give rise to fatal pneumonia or to multiple abscesses. Cases of this type are very often fatal, whereas in the mild type antiseptic treatment is usually successful, although there is some danger of recurrence.

An early diagnosis and isolation of infected animals are first steps in the control of the disease, as well as prompt attention to wounds and abrasions, however slight, around the feet.

## HOUSING IMPORTANT IN WINTERING BEES

NOW is the time for the beekeeper to arrange the details of how best to protect his bees during the coming winter, whether the bees are to be in the cellar or in packing cases outside. The cellar, states C. B. Gooderham, Dominion Apiarist, should be fairly dry, dark at all times, well ventilated, well insulated against outside temperatures, and maintained at an even temperature of about 48 degrees F. The bees should be brought in as soon as possible after the last good cleansing flight, usually about the first week of November. If guards are placed over hive entrances as a protection against mice, they should fit firmly so that the mice cannot move them.

For outside wintering, the bees may be placed in single, double or four colony cases. The four colony case is the most economical in preservation of heat and in construction, because each colony is protected on two sides by other colonies. For packing material, planer shavings, forest leaves, chaff, and moss can be used. There should be from three to six inches of packing on the bottom and on all four sides, with a cushion of six to eight inches thick on top. The colonies should be placed in the cases, with all the packing finished except on top before the bees are fed. The reason for this is that there should be no disturbance of the bees after they have been fed. The latter end of September is a good time to place the bees in the cases. In British Columbia, the Kootenay hive-case has been generally adopted as the best all-the-year-round form of protection. Further information will be found in Publication 674 'Preparing Bees for Winter', a copy of which may be obtained by writing to Dominion Department of Agriculture, Ottawa.—*Department of Agriculture, Canada.*

## What the Scientists are doing

### PROGRESS IN MEDICAL AND VETERINARY RESEARCH

MEDICAL and Veterinary Section of the Indian Science Congress this year was presided over by Dr K. V. Krishnan of the all-India Institute of Hygiene and Public Health of Calcutta. The recorder was Mr M. R. Mahajan, Animal Husbandry Officer, Ajmer-Merwara. Fifty-seven papers were contributed to the section, which dealt with all aspects of researches in the field of Bacteriology, Serology, Protozoology, Malariology, Plague, Helminthology, Nutrition and Toxicology, etc.

Dr Krishnan (Calcutta) first read the papers contributed by him and his associates on (1) 'Bacterial standards for ice-cream' in which they advocated class A with no Coliform in less than 0·1 C.C. and total count not more than 1 million per C.C. and class B with no Coliform in less than 0·01 C.C. and total count not more than 2 millions per C.C. (2) 'Method of determining the temperature inside Autoclaves during sterilization' in which, out of different methods employed, the one that gave best results was with thermo-couples. Drs Panja, Chatterjee and Minett and Mr Mahajan contributed to the discussion.

The first author of the paper contributed by Dr S. K. Chatterjee and S. Ahmed (Patna) then read 'Cholera epidemic in Bihar caused by the 'Ogawa' type of V. Cholerae' in which the authors showed that widespread epidemics could also be caused by this type which is otherwise associated with sporadic outbreaks only. Drs Panja, Krishnan and Minett contributed to the discussion.

Dr Panja (Calcutta) then read the papers contributed by him namely (1) 'Treatment of cholera by atebrin' which had given encouraging results in 20 cases. (2) 'A pathogenic organism isolated from stool of a case of hill diarrhoea' which was different from dysentery bacilli. (3) 'A simple test for differentiating Anthrax bacillus from subtilis group of bacilli' by the addition of brilliant green in culture media. (4) 'Aetiology of ulcus tropicum (Naga sore)' attributed to fusiform bacilli that show pus formation.

Drs Chatterjee, Krishnan and Sankaran and Messrs Mahajan, Bose, Harkishanlal and S. Chatterjee participated in the discussions on these papers.

Mr Rajagopalan's paper on 'Cystine hydrochloride broth for black quarter vaccine' in which the drug is suggested to be used in the routine manufacture of the vaccine to produce anaerobiosis, was read by Dr B. C. Basu.

The following second set of papers contributed by Dr. Krishnan and his associates were then taken up. These were perhaps the most interesting papers in the section as transfusion material had been prepared and tried with considerable success in starvation anaemia that was so frequent in the recent Bengal famine. Dr S. Mukerjee introduced (1) 'Biological testing of transfusion material' such as serum and plasma, by using a cat as the experimental animal and classifying the material as of 1, 2, 3 quality'. Drs Krishnan and Panja contributed to the discussion. The other papers were read by Dr Krishnan, (2) 'Hydrolyzed proteins as transfusion material' in which a mixture of amino-acids and peptoids produced by the hydrolysis of proteins was prepared and used with encouraging results in the treatment of cases of starvation and the material produced pronounced effect on cases of oedema due to starvation. Those who contributed to the discussion included Drs K. C. Sen, B. C. Bose and S. K. Basu. (3) 'Albumin as transfusion material' has given encouraging results which the authors tried on account of the unique advantage it has of being administered in high concentrations. (4) 'Chemical methods of obtaining dry blood proteins for transfusion purposes' as an alternative to physical methods has been developed by the authors on the observation made by Hardy and Gardener (1910) that the temperature coefficient of denaturation of proteins by alcohol or acetone is of the order of 600 per 10 C. Drs K. C. Sen, B. C. Bose and S. K. Basu took part in the discussion.

The paper contributed by Messrs H. N. Ray and H. K. Lal (Mukteswar) 'Studies on Surra II, Two autopsies. A horse and a dog dying of experimental infection with Trypanosoma evansi' was then read, in which the authors while confirming the view of Hawking and Greenfield that the visceral lesions are more

harmful to the patient than nervous ones, raise the question of study of carbohydrate imbalance as a causative factor of such lesions. Next was the paper by Messrs H. N. Ray and S. N. Sapre (Mukteswar) 'Studies on Surra III. The problem of detecting Su ra in equines and bovines' by means of complement fixation test and nitric acid, are recorded especially for the detection of 'Carriers'.

Mr B. C. Basu (Izatnagar) then read his following three papers: (1) 'Studies on fowl malaria (Plasmodium gallinaceum)' which indicates this, as being highly fatal in the cases of experimental birds with no relapse but recovered birds develop solid immunity and as a prophylaxis suggests infecting the birds and then treating them with anti-malarial drugs. (2) 'A note on Aegyptianella pullorum infection in fowls in India' is recorded, in which the parasite was isolated and condition reproduced by blood inoculation and the question is under study whether the parasite was merely a stage in the development of spirochaeta anserina. (3) 'Malaria control at Izatnagar by anti-mosquito measures' describes attempts made to control mosquito breeding in an area of 3 sq. miles by weekly application of 'Paris green' and 'Malariol' with considerable reduction of the cases of malaria. Dr Bhattacharji of Malaria Institute of Delhi during the discussion raised various questions of relative importance that affect the control measures.

Mr Mahajan (Ajmer) then read his paper 'Animal Husbandry in relation to War' wherein the author drew the attention of workers to the importance of developing and utilizing the resources for the increased production of animals and animal products origin so necessary to the country's war efforts. Dr K. C. Sen gave figures of milk statistics and stressed the great necessity of augmenting the milk production in the country which he said, was one of the fundamental factors in human nutrition.

Dr K. C. Sen (Izatnagar) then read his paper 'The vitamin A potency of some green fodders' wherein the author has found that the amount of carotene determined by the alkali digestion method agree well with the amount determined biologically using B-Carotene as the standard. Dr G. Sankaran was of opinion that Dr K. C. Sen's work showed that it was possible to replace vitamin A of animal origin by carotene which was being used to vitaminize the hydrogenated edible fats. Dr Bashir Ahmed said that the question of stability of carotene was doubtful and its relative value when compared with vitamin A from fish liver oil remains to be determined.

Another paper read was on 'Osseous development in the hand as an index of skeletal development' by Dr Bose by which it was possible to elucidate approximate age groups. Several speakers took part in the discussion.

# What would you like to know?

*Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Service in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.*

**Q. How is cream cheese manufactured ?**

A. As the name implies, cream cheese is a soft variety of cheese made from cream or a mixture of cream and milk. It should have a mild acid flavour and a smooth texture. There are several varieties of cream cheese and consequently several different methods of manufacture. The following, however, are the two best known methods of making this type of cream cheese :

(i) *Double cream cheese :* This type is made from rich cream or 40 to 60 per cent butter fat. Fresh cream straight from the separator is cooled down to 60 to 65°F and kept at this temperature for 18 to 24 hours, a small quantity of 'starter' may be added, say one teaspoonful to one gallon of cream. The cream is then ladled into a draining cloth and hung up in a cool place to drain. While draining, the curd must be frequently scraped off from the draining cloth. After draining for 24 hours, the draining cloth is wrapped around the curd, which is then placed on the draining rack and light pressure is applied from above. The cloth is frequently opened and the curd scraped off from the cloth and then the light pressure renewed. When the curd is sufficiently dry, salt is added according to taste, i.e. 1 to 1½ oz. per gallon of cream will suffice, and the salt is worked in thoroughly with a fork.

The cheese should be consumed when fresh. It is usually marketed in 4 oz. and 8 oz. cylindrical packages, but may also be packed in cardboard cartons.

One gallon of cream will yield about 8 lb. of cheese.

(ii) *Pommel cream cheese :* This type of cheese is made from a mixture of milk and cream. Two parts of milk are mixed with one part of cream, both ingredients preferably being fresh and sweet and the cream containing not less than 40 per cent fat. The mixture is cooled down to 65°F. 'Starter' is added at the rate of one teaspoonful for each gallon of the mixture. Ten to twelve drops of rennet diluted with half an ounce of water are then added and thoroughly stirred for 4 or 5 minutes. The mixture is then allowed to coagulate at 65°F only. During the first 2 or 3 hours the surface of the mixture should be occasionally stirred gently to prevent the cream rising to the surface. Coagulation will usually take place in 10 to 12 hours. The curd is then ladled on to the cloth on the draining racks and allowed to drain for about half an hour after which the cloths are tied up and hung to drain.

To facilitate drainage the bags are opened frequently and the curd scraped off from the cloth. The draining period varies from 6 to 10 hours, at the end of this time the curd which should then have a fairly firm consistency, is salted according to taste, the amount needed being 1 to 2 oz. per gallon of mixture.

This is normally marketed as small cylindrical cheese weighing about 4 oz. The cylindrical moulds are lined with blotting paper and placed on a straw mat on a board. The curd is then filled into moulds and kept to drain for a while. The mould is then removed leaving the cheese standing on the mat.

This cheese is eaten when freshly made.

**Q. What precautions should we take during cattle epidemics ?**

A. These entail prompt reporting of disease to the nearest revenue authority who will then notify the veterinary authorities. Once the veterinary officer deputed to deal with the outbreak has established the nature of the disease, he proceeds to follow his departmental instructions regarding the particular needs of the situation in the field. The measures he will undertake, and in which he is entitled to expect active cooperation include effective isolation of ailing animals, proper disposal of carcases, disinfection, and immunization where vaccines and sera are available. There must be no attempted salvage of hides : there is no law forbidding this common practice but it is probably responsible for much active spread of

disease. Similarly there are no laws laid down to control the movement or sale of sick animals or their products viz. milk and meat, but it is essential that the advice which will be given in this connection by the veterinary officer should be strictly followed.

## HOW TO KEEP HENS FROM DYING

THE easiest way to get more poultry and eggs, with both feed and equipment scarce, is to reduce poultry losses. There are many things flock-owners can do to reduce losses.

1. Sell old hens not needed for breeders, or else house hens and pullets in separate buildings.
2. Scrape, sweep, scrub and scald the laying house floor before putting layers in. After floor is dry, use a good disinfectant on floor and walls. Clean and disinfect all equipment.
3. Give layers elbow room—four square feet of floor space per bird for light breeds, four and a half for heavier ones. Provide at least 20 linear feet of mash hopper space (open on both sides) for every 100 birds. Have one nest for every six birds. If trap nests are being used, one for every four birds.
4. See that layers have at least five to seven gallons of water daily per 100 birds. Remove chill from water in cold weather, so birds will drink all they need. Water is the cheapest thing in a hen's ration ; eggs are mostly water.
5. Provide ventilation without drafts.
6. Select pullets carefully at housing time. Reject those that are lame, undeveloped and those that have grey eyes with irregular pupils.
7. Keep a clean supply of grit before the layers at all times ; also oyster shell or some other good source of calcium.
8. To maintain body weight, feed mash moistened with water or skim-milk (or mash pellets) at noon—as much as the layers will clean up in a half-hour.
9. Cull hard and often to save feed and reduce losses. Birds won't be disturbed so much if culled at night with a flashlight.
10. Act promptly if disease starts. Get an accurate diagnosis from a veterinarian, or a poultry specialist who knows what it's all about. Remove dead birds from the laying house and completely burn them or bury them so deep that dogs, rats or other animals can't get at them.
11. Get rid of rats ; they waste feed and spread disease.
12. Don't let chickens have the run of the barnyard and hog lots.—*Department of Agriculture, Canada.*

# *What's doing in All-India*

## BOMBAY

By J. A. Daji

WITH a view to intensify the 'Grow more food' campaign and to give a fillip to greater production of foodgrains, the Government of Bombay has sanctioned a sum of Rs. 12,15,000 for the purchase and distribution of seeds of improved varieties for the southern division. This will not only extend the area under food crops but will also help to increase the yield per acre. It is proposed to supply seed at concession rates to those cultivators who sow additional areas under food crops as also those who substitute food crops for non-food crops. A special staff consisting of one gazetted officer and six assistants has been appointed to put the scheme into execution. The registered seed growers from whom the selected seed is to be purchased will be given a premium up to a maximum of 25 per cent above the local controlled price of foodgrains.

The supply of groundnut cake to the cultivators at concession rates is one more step in the drive. Fifty thousand tons of groundnut cake are to be purchased and stored for the ensuing year at a controlled price of Rs. 75 per ton. It will be supplied to the cultivators for manuring rice during the *kharif* season and irrigated wheat during *rabi*. A subsidy not exceeding Rs. 40 a ton will be paid by Government to all such farmers.

An example of what can be done by co-operation and team work in increasing food production is set by the cultivators of a small *peta* in East Khandesh. The cultivators of Bhadgaon formed a Joint Farming Society and every member of the Society not only increased the area under food crops in the piece of land allotted to him but also brought some waste land into cultivation. As a result of this, the Bhadgaon *peta* showed an increase of 49 per cent in its food-crop-area as against an increase of 5 to 10 per cent in the adjoining talukas. To have 50 per cent more area under food crop in a predominantly cotton tract is an achievement of outstanding importance and everyone connected with the Society is highly pleased with its efforts.

### *Farmers' weeks*

Officers' Days and Farmers' Weeks have now come to stay and are becoming more and more popular. Demonstrations and shows are organized at suitable times, at various farms and development centres in the province, when the farmers and Government officials, both big and small, meet. They compare notes while the farmers get their first hand information of the activities of the Agricultural Department. One such demonstration was held at Government Farm, Dharwar, in November last when nearly 250 cultivators from various parts of the district accompanied by their respective *mamlatdars*, *mahalkaris* and assistant rural development inspectors attended the show for three days. They were taken round the farm and the various methods of cultivation were explained to them, in all of which they evinced a keen interest.

Another such demonstration was held in October at the Government Farm, Jalgaon, which was attended by 20 officers of the various departments. The attendance of the farmers was rather poor on account of the continuous heavy rains during that week which made it imperative for them to stay at their own farms.

### *Jarila cotton*

This is the seventh year of the working of the Jarila Cotton Seed Distribution and Expansion Scheme in Khandesh.

Nearly 800,000 acres have been sown with cotton in Khandesh this year and the whole (95 per cent) of this area is under Jarila. The Agricultural Department distributed, through its approved stockists, about 51,000 bags of Jarila seed. This year the crop progressed well till about the middle of October when it was damaged considerably by the unusually heavy rains. As a result of this, the crop is estimated to be only about 70 per cent of the normal. The cotton is also inferior in quality. These abnormal weather conditions have brought out the special peculiarity of Jarila as it stood

these adverse conditions better than *desi* cotton. About 75,000 bags of seed are proposed to be stocked for the next year.

The adverse effects of the October rains have depressed the marketing of Jarila cotton. The demand seems to be below normal and it is offered Rs. 40 to 50 less per candy than the standard Jarila quotation in Bombay.

The Cotton Control Act has been introduced in East and West Khandesh and the application of Cotton Transport Act to the Khandesh tract is under consideration.

### Mango budding

Amongst the problems of horticultural interest which have seriously occupied the minds of research workers in India in the last decade, the propagation of mango by budding is probably the most prominent. The mango, in India, has been universally propagated by enarching which is a primitive and clumsy method, involving much labour and expense. Attempts to replace it by shield-budding have met with only partial success. Though remarkable success in budding the mango has been achieved by various workers in the country, it has not been possible to establish a commercial nursery and to transport potted bud-grafts to distant places. The percentage success with the usual T method of shield-budding when practised by inexperienced hands is very low and the operation of transplanting of ground-grown bud-grafts is usually attended by a large percentage of death.

The more recent work of Mr S. R. Gandhi, Superintendent, Ganeshkhind Fruit Experimental Station, Kirkee, merits attention of all interested in this line. Mango bud-grafts are at present being raised on a very large scale in a ground nursery and successfully transplanted in handy earthen pots which can be conveniently transported by rail. The percentage of successful bud-grafts averages 60 and absolutely no casualty occurs in transplanting them. It is interesting to note that the method of budding adopted by Mr Gandhi, called 'Forkert method', differs considerably from the usual method of shield-budding. The operation on the stock consists in pulling out a rectangular panel of bark at a point in the stem about 4 to 6 in. from the ground. The cut bark of the panel is then pulled out by hand in one strip so as to expose the wood below. The scion bud which is prepared as in shield-budding is then gently inserted on the panel in such a manner as to rest in the angle between the flap and wood of the stock. The flap is then loosely held in its original position over the bud so as to cover it entirely. The whole operation is then completely bandaged by means of waxed tape. After three weeks the tape is removed and the flap resting over the bud cut away. The bud begins to sprout within three weeks of exposure and then the part of the stock above the bud-joint is removed. The most suitable weather conditions for budding in Poona are obtained in August and September when the weather is moist and cool but not actually rainy. The bud-graft remains in the nursery for a year more and is removed for sale in the following year during the monsoon. By this time it attains 3 to 4 ft. height and is a graceful plant with a straight tall stature and broad healthy foliage. Two months before removing the graft from the ground, it is necessary to cut the tap root and encourage fibrous roots near the stem. This is to ensure safe removal of the root-ball without giving a shock to the plant in the process of transplanting. The size of the root ball is 3½ in. all round the stem which is easily accommodated in a handy earthen pot of 7 in. × 7 in. size. The photo plate shows mango bud-grafts prepared on a mass scale at the Ganeshkhind Fruit Experimental Station, Kirkee. Mr Gandhi is of opinion that this new method of budding can be adopted with equal success in other parts of India for budding mango and other evergreen fruit trees like *chiku* (*Achras sapota*).

## BIHAR

By A. P. Cliff

*Special Officer, Grow More Food Campaign, Bihar, Patna*

THE harvesting and threshing of the paddy crop was completed and it is believed that a record crop was obtained. Good cold weather rains over most of the province caused the considerably increased area of the *rabi* crops to give a good yield. Rather

heavy rains late in March delayed harvesting to some extent and were thought to have damaged some of the crops already harvested. It is considered however that the damage from rains was on the whole slight. It is reported that a considerable proportion of the canal irrigated areas was this year doubly cropped and the output of *rabi* thereby considerably increased. On the whole the provincial position as regards foodgrains is considered to be quite satisfactory.

The number of minor irrigation works sanctioned by 31 March 1944 rose to 3,023 estimated to benefit 8,20,086 acres and to cost Rs. 12,79,171. Considerably increased staff has recently been appointed in connection with the execution of these works, and every effort is being made to complete all sanctioned schemes before the next monsoon breaks. At the end of March 559 schemes are reported actually completed.

### *Bullock prices*

Prices of good draught bullocks are still very high ; up to Rs. 1,000 per pair for very ordinary sized animals. There is considerable grumbling that the high price of draught bullocks is hindering cultivation. It is believed however that cultivation of foodgrains, done at all efficiently, is at present so profitable, that it can bear the high costs of bullocks. This appreciation in the value of work cattle is reported to have stimulated interest in cattle-breeding and keeping. The castration of young scrub bulls is reported to have greatly increased, and there is every sign of a considerably increased interest in the whole question of livestock, breeding and management, particularly feeding.

The Agricultural Department is engaged in the collection of a record amount of *rabi* seeds, and in the supply of castor cake manures to cultivators on a very large scale. Conflict between the necessity for supply of seed and the desire of the larger concerns to retain their crops to ensure the food supplies of their employees has created a great difficulty ; but now a closer liaison between the Agricultural Department seed purchasing agencies and the foodgrain purchasing organizations of the Commerce Department, is being attained. The position regarding the supply of seeds of the improved varieties of paddy is still very difficult, as somehow, in Bihar, the growers of paddy, even the large ones, seem quite unable to make firm business arrangement for seed multiplication for the Department. The supply of rice in the province is apparently of such overwhelming importance, that the farmers are tempted to divert their whole output for their own use or for the Government. Some very special scheme is apparently necessary for multiplication and supply of sufficient stocks of seed of the improved varieties of this particular crop.

Recent legislation amending the Sugarcane Act has made statutory the Sugarcane Varieties Advisory Committee, first tentatively set up by the writer in 1936, and since then working on an advisory basis. This legislation empowers the prescribing of special varieties for the different sugarcane tracts of the province ; and also provides for differential payment against any varieties that may be grown in spite of the Department's recommendation. For north Bihar Co. 313, 395, 513, and 508 and for south Bihar Co. 313, 453 and 513 have been declared approved varieties under this amended Act.

The late monsoon and good cold weather rains seem to have delayed the ripening of the crop somewhat, as the early recoveries of sugar were reported to be about 0·5 per cent below those of last year ; but it is not expected that this difference will persist. Although the local Government's price policy was widely reported to have resulted in a considerable reduction in the area of new cane planted, it is very doubtful if the reduction in area has been as great as at first anticipated. The ample cold weather rains have certainly enabled considerable areas that carried early *rabi* crops to be planted to cane in good time and in fair condition.

### *Exhibitions and shows*

During the quarter under report there was a large number of agricultural fairs and exhibitions at which the Department was required to stage 'Grow more food' shows. The greatest was in connection with the War Services exhibition in Patna during January, when a really good show was made. Although all these exhibitions attracted very considerable attention from the more educated section of the public, they threw a very great strain on the Department's inadequate staff which is extremely inadequate to cope with the increased work specially the grow more food campaign. One of the Department's major problems is to find the staff required for this work, and for agricultural reconstruction. It has already been decided to reopen the Bihar Agricultural College as quickly as possible, but the staff position causes much concern.

# NORTH-WEST FRONTIER PROVINCE

By P. C. Raheja
*Sugarcane specialist, N.W.F.P.*

The effort at grow more food has been in four directions. Firstly, to bring more of the culturable wastes that could be served by the existing canals under the food crops ; secondly, to turn as much of *ek-fasli* area as possible into *do-fasli* ; thirdly, to encourage larger production in unirrigated areas by methods such as *taccavi* loans, increased seed distribution of the improved types suitable to different tracts, access to city refuse at nominal rates to help increased production of vegetables in scarcity areas and finally maximum utilization of village wastes for manuring of lands. The extra area brought under the crops due to increased irrigation facilities is detailed below :

| Year | Area (irrigated) acres | Progressive increase in area acres |
|---|---|---|
| 1937-38 | 1,047,209 | .. |
| 1938-39 | 1,055,738 | + 8,529 |
| 1939-40 | 1,065,187 | +17,978 |
| 1940-41 | 1,079,548 | +32,339 |
| 1941-42 | 1,079,162 | +31,953 |
| 1942-43 | 1,080,995 | +33,786 |

During *kharif* season of 1943-44, it is reported by the Superintending Engineer, Northern Circle, that there has occurred an increase of 16,417 acres under the *kharif* crops and still further increases are expected because of better irrigation facilities which are being provided in due course. The local Government has directed all the Deputy Commissioners of the districts that they should, so far as possible, distribute all their *taccavi* grants primarily for the distribution of improved seeds and such other purposes that are likely to yield quick results in the production of food grain crops. The Department of Agriculture which is mainly concerned with the propaganda work is putting in greater efforts to demonstrate the making of compost manures and their utilization on the farmers' lands.

### *Irrigation projects*

During 1943-44 the New Michni branch of the Doaba Canal was completed at a cost of Rs. 2.83 lakhs and is designed to irrigate an area of about 15,000 acres. Joi Sheikh is an old zemindara canal with a *kuchha* head which is very often washed off every season. The trouble gets acute during the *kharif* season when crops require frequent watering. The local Government with the assistance from the Government of India has now undertaken to extend the headworks of the Kabul River Canal and deliver supplies therefrom to Joi Sheikh. With permanent water supply the expected increase in area will be over 25 per cent of the existing area of 31,000 acres commanded by this canal.

Yet another project underway is the further utilization of the spare supplies of Bara river for irrigation purposes. At present the water is dammed occasionally by the zemindars for irrigating the vineyards of Sheikh Muhammadi and its neighbouring villages. The cantonment and city supplies are obtained at Bara Fort. By the extended project the Bara tunnels at the head of the Bara Canals will be widened and will thereby ensure better irrigation facilities to the villages which are at present frequently inundated with immense losses to the cultivators every year.

Kabul River Canal Right Bank Lift Irrigation Scheme is being executed to provide irrigation to over 20,000 acres. Due to the silting up of the Takkarwah distributory of the Paharpur Canal the remodelling of it has been taken up and will shortly be completed.

At present Toi water runs to waste causing much damage by erosion of excellent lands through which it runs. The proposal is to dam the supply and distribute it equitably when it can be best utilized for irrigation of the crops. By this means a good deal of area at present dryfarmed in Kohat district will have a secure water supply. Recently, Sir William Stampe was invited by the local Government to advise on the utilization of electrical power for grid irrigation in Kohat district chiefly for the purpose of raising water for lands where irrigation facilities can profitably supplement the precarious rainfall. The Electricity Department is taking energetic steps to lay out the cable line in as short a period as possible.

### *Fruit drying*

During the last fruit season about 3,600 tons of dry processed and packed fruits were supplied to the Food Department of the Government of

India for supply to the Army. The contractors have been further informed that an equal quantity of fruit will be accepted by the Government through the Cooperative Department on behalf of the Food Department in the coming season as well. It is expected that all the 45 centres will work enthusiastically towards this end. This has given fillip to high bids for orchards so that prices have gone up by leaps and bounds. Five times the normal contract price is now expected by every orchard owner. Well maintained orchards got exorbitant bids running to about Rs. 1,000 per acre.

It has been decided by the Government to stop further opening of centres within the settled districts. Fresh centres are being organized at Temalgarah in Dir State, Malakand Agency and Miranshah in North Waziristan Agency. Dir State is a rich fruit growing valley and it is expected to yield about 6,000 md. of dried deciduous fruits and apple rings. It is principally for drying of apricots that Miranshah has been selected as a new centre.

### *Technical mission visits*

Technical Mission of Dehydration consisting of Dr J. C. Fiddler of Cambridge and Mr T. C. Crawhall visited the province in December last. They were much impressed by the progress of fruit drying and processing work in this province. They discussed various aspects with the technical experts of the various departments concerned and gave suitable advice where necessary. Their report will, we hope, be shortly available to the Government for improving the industry at large.

### *Canning industry*

The construction of the canning factory in the vicinity of the Agricultural Research Station, Tarnab, is proceeding ahead. The factory is being set up by the Food Department. It is arranged to lease it to a limited concern for the duration of the war when the provincial Government may take it up for working it on cooperative lines. It will be an automatic plant with an outturn of about 500 md. of tinned fruit per day. In the first instance it is proposed to can deciduous fruits only. Later if facilities permit and suitable arrangements for supply of Seville oranges and lemons are possible, preparation of squash, jelly and marmalade will be undertaken on a comprehensive scale.

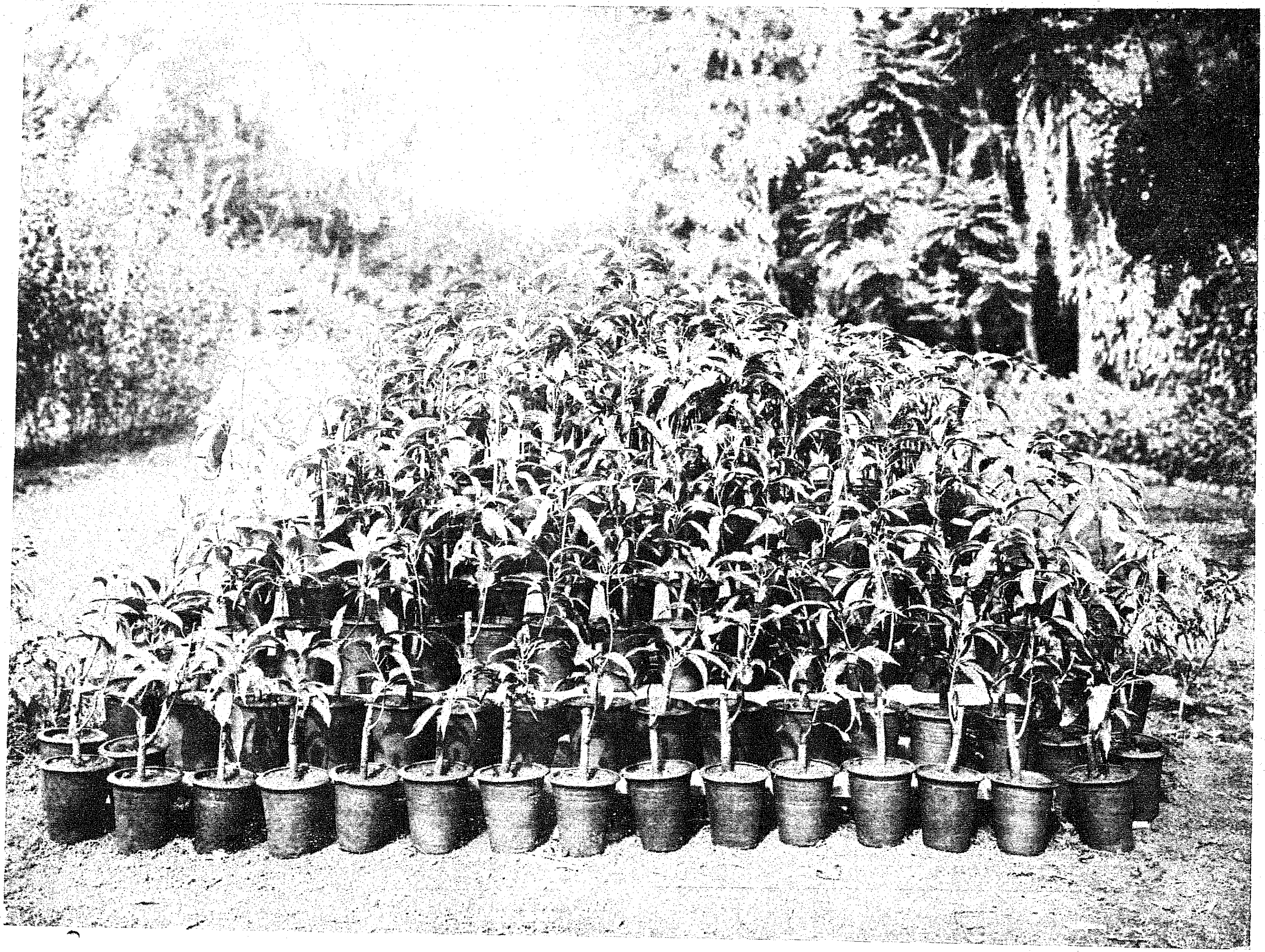
### *Gur control*

Although the province has an insignificant sugarcane area compared to the United Provinces or the Punjab, yet it is the second largest *gur* exporting province in India. It exports roughly over 40,000 tons of *gur* to the Punjab, Sind and Baluchistan. About 80,000 acres of the sugarcane area are concentrated within the Peshawar Valley and *gur* export taxes immensely the transport facilities available to the province. During normal times lorry transport far exceeded the railborne traffic. Now the latter is strained to its maximum. By reasons of the issue of the 'Gur Control Order' and the restricted facilities for movement of the commodity a crisis occurred in the *gur* market. Huge stocks accumulated with the licensed dealers and they had to stop further purchases of *gur*. Prices toppled down rapidly and touched lowest point. The local Government, in the circumstances relaxed conditions of purchase and sale and the prices have since improved considerably. Their own purchases, of about 2,000 tons, on behalf of the Food Department, Government of India, have very much helped to ease the situation.

# LOCUST CONTROL IN THE GWALIOR STATE

By C. B. L. Bhargava, M.Sc., Assoc. I.A.R.I.
*Entomologist, Agriculture Department, Gwalior State*

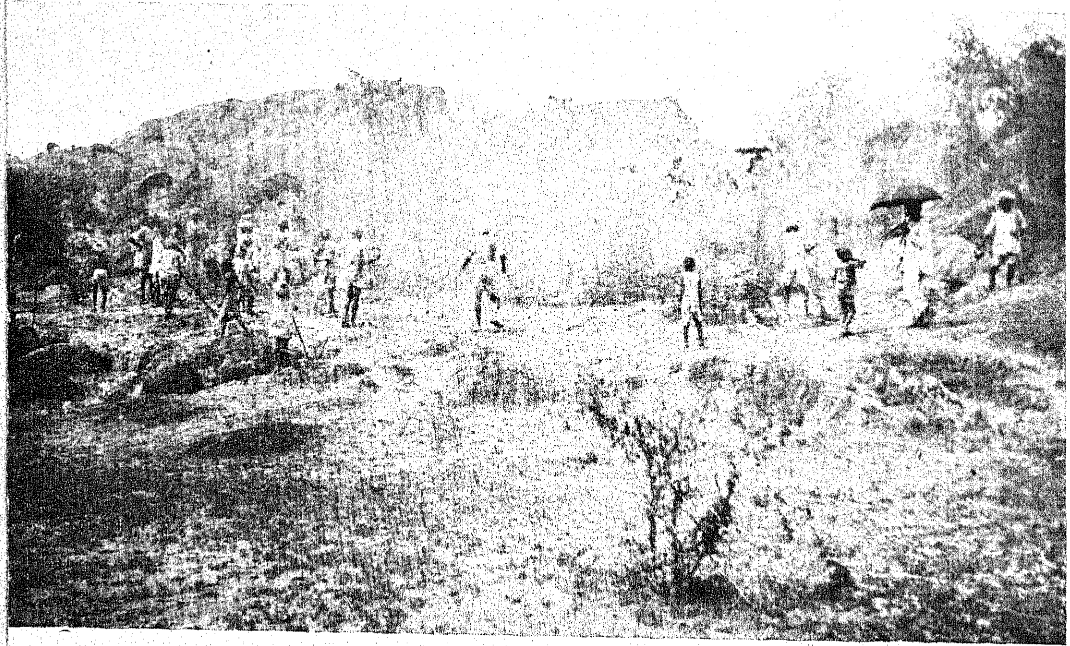
During 1940, the desert locust, once again became active after a lapse of nine years. The swarms produced in Persia, Baluchistan, etc. in spring, fly eastwards into Sind, Rajputana, and the United Provinces by May and June for breeding purposes during the monsoon. Gwalior State, adjacent to Rajputana, lies within the range of invasion of these immigrant locusts. The Chambal river which bounds the State on the north, north-east and north-west has got extensive ravines suitable for oviposition.



Mass production of mango bud-grafts of the Alphanso variety at the Ganeshkhind Fruit Experiment Station, Kirkee. The potted bud-grafts were photographed before packing for distant journeys.

PLATE 32

Burning and beating of Hoppers in deep Ravines



[See page 328

Burning of hopper.

PLATE 33.

During the last onset of this pest, the cultivators sustained a heavy loss, and it was feared that unless timely precautions were taken to control it, the crops in the cultivated areas would be seriously in danger. Therefore, on receipt of a warning from the Locust Warning Organization, New Delhi, a scheme for an anti-locust organization was submitted to the Gwalior Government. The Durbar were graciously pleased to approve and to sanction Rs. 20,000 for control work in the state.

As soon as the scheme was sanctioned a Central Locust Control Organization was set up with the Revenue Minister as the Chairman, the Director of Agriculture as the Administrative Officer and the Entomologist as the Technical Adviser. For the successful working of the scheme a net-work of control organizations throughout the state was essential in which cooperation and help of each individual, whether official or non-official was a matter of prime importance. With a view to meet these objects the scheme was drawn up on the following basis.

### Control organization

The State is divided into 11 districts, 39 tehsils and 16 *tappas*. For the purpose of control work, control organizations, known as Locust Boards, were set up in each district and tehsil, with Subas and Tehsildars as locust officers. They were assisted by government officials and zemindars as non-official members, who acted as members of the Board. The Inspectors of Agriculture who were given necessary training in the methods of locust control and are therefore thoroughly acquainted with the life-history and habits of locusts, acted as technical assistants in the districts. Necessary chemicals and implements such as sodium fluosilicate, bran, molasses, spraying and dusting machines, etc. were procured and kept at important centres.

A Locuts Intelligence Service was organized throughout the state to observe and report the movements of the locust. The importance and utility of this organization were never underestimated. The success of the control methods largely depends upon the timely information received by the locust officers. Printed cards for reporting locust incidence are kept with the *patwaries* of each village, through whom information about the movements and whereabouts of the locust reaches the authorities concerned within the shortest possible time.

### Anti-locust training

Proper control and intelligence organization having been set up and necessary equipment obtained, the next step was taken to educate and train the workers in the villages in the anti-locust work. It was essential to impress upon the villagers and the cultivators the danger which lay ahead of them, and the ways and means by which the state proposed to combat the same. Their help and cooperation was secured through wide-spread training and propaganda. Printed leaflets giving instructions were distributed free of cost throughout the State. Touring officers and the village school teachers organized meetings in the villages and read out the leaflet. Demonstrations and lectures with magic lantern slides and cinema films were arranged in exhibitions, *melas*, cattle shows, etc.

During the present cycle of infestation the locust swarm was observed for the first time in the State in the second week of September 1941, at Pargana Suwasra in Mandsaur district. During September, October, and November 1941, the locust situation grew serious throughout the State. But thanks to timely precautions, no damage was done to the crops.

### Successful operations

The locust situation improved in the first half of 1942, but started assuming a dangerous form in the middle of June. Heavy breeding took place during July and August in several villages of the districts Sheopur, Morena, Bhind, Gird and Shivpuri. Oviposition mainly took place in the ravines of the Chambal river and the Sind. The area affected by the locust breeding is estimated to be about 1,52,280 *bighas*.

Immediately, on receipt of imformation regarding locust breeding, control operations were set in. The eggs and hoppers were completely destroyed at all places within a month and a half, before any material damage could be done to the standing *kharif* crops. Different methods of control were adopted to suit local conditions. In large areas and in places where ploughing was possible, egg masses were exposed to the surface by the plough, which were then collected and destroyed by school boys and children. Hoppers were destroyed by burning and beating on the bushes. In the fields, where crops were standing, trenches were dug and hoppers driven into them and destroyed by burning.

As a result of the anti-locust organization, crops to the extent of Rs. 9,47,000 were saved from destruction, with an expenditure of Rs. 3,507 only. The low cost is chiefly due to the fact that during control operations all work was done by the villagers themselves. Very little money was spent on labour. The anti-locust organizations were made so perfect by training and propaganda that in a number of places the cultivators dealt with the locusts on their own initiative. The Imperial Entomologist visited the State in September 1942, and discussed the anti-locust scheme with the Director of Agriculture. He also visited a few sites where actual breeding had taken place. He appreciated the organization set up and the control work that was done.

### *Improved situation*

The locust situation has improved considerably this year. Though swarms are found moving in several districts of the State, no egg laying has yet taken place anywhere. The Revenue Minister and the Director of Agriculture are taking very keen interest in the locust control work. The writer feels indebted to them for their assistance during the control operations.

## MILK RECORDING NEWS

RECORDS for lactations completed during April 1944 have been received from five of the milk recording centres. Twenty cows reported averaged 2,650 lb. and five buffaloes averaged 2,922 lb. Records from Sanand for February and March 1944 and from Karachi for March have also been received and are given below :

### *Hariana cows*

Beri area (Rohtak district, Punjab). Ten cows completed their lactations averaging 3,021 lb. with a maximum yield of 4,284 lb. and a minimum yield of 1,215 lb. Selected records are as under :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily lactation yield recorded lb. |
|---|---|---|---|---|---|---|
| LK.5 | Bagru S/o Jota | 3 | 1.5.43 | 338 | 4284 | 19 |
| LK.3 | Ramsarup S/o Udmi | 5 | 2.7.43 | 281 | 3673 | 23 |
| BR.66 | Désram S/o Palli | 8 | 5.6.43 | 300 | 3300 | 20 |
| BR.89 | Dhara S/o Hasti | 7 | 17.7.43 | 272 | 3264 | 21 |
| G.H.25 | Mansa S/o Chimanlall | 4 | 2.6.43 | 303 | 3333 | 17 |
| B.R.80 | Kalu S/o Devki | 8 | 5.7.43 | 274 | 3264 | 21 |

### *Kankrej*

Sanand area (Ahmedabad district, Bombay). Records for three cows that completed their lactations during February, sixteen cows during March and five cows during April 1944 have been received. The average yield for February 1944 was 2,015 lb., for March 1944 2,113 lb. and for April 1944 it was 1,395 lb. The maximum yield was 2,755 lb. and the minimum 511 lb. Selected records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Date of drying | Milk yield lb. |
|---|---|---|---|---|---|
| — | Soma Laxman | 2 | 20.5.43 | 28.2.44 | 2197 |
| — | Mehar Bhala | 1 | 21.4.43 | 4.3.44 | 2133 |
| 379 | Rabari Kalyan Kala | 2 | 21.3.43 | 17.3.44 | 2572 |
| 552 | Vershi Bhata | 3 | 25.5.43 | 10.3.44 | 2570 |
| 557 | Soma Laxman | 1 | 10.6.43 | 6.3.44 | 2126 |
| 564 | Soma Ranchhod | 1 | 23.6.43 | 20.3.44 | 2755 |
| 572 | Rabari Hari Bhagwan | 1 | 20.7.43 | 31.3.44 | 2201 |
| 552 | Rabari Vershi Bhata | 1 | 14.5.43 | 8 3.44 | 2691 |
| 542–A | Rabari Ramoshi Bhala | 1 | 5.6.43 | 10.4.44 | 2170 |
| 573 | Rabari Hari Bhagwan | 1 | 30.7.43 | 10.4.44 | 1874 |
| 574 | Rabari Ranchhod Shibhss | 1 | 25.8.43 | 10.4.44 | 1734 |

### *Sindhi cows*

Malir area, Karachi. No cows completed their lactations during March and in April one cow completed her lactation yielding 4,204 lb.

### *Local cows and buffaloes*

Chata area (Muttra district, United Provinces). Two cows and five buffaloes completed their lactations under record in April 1944. These two cows yielded 1,636 lb and 1,377 lb. of milk

respectively. The five buffaloes averaged 2,922 lb., the highest yield being 3,750 lb. and the lowest 2,320 lb. The records are reproduced below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 19 Cow | Chirmol | 3 | 8.9.43 | 210 | 1377 | 10 |
| 2 „ | Ramdayal | 6 | 5.10.43 | 188 | 1636 | 11 |
| 61 buff: | Lukki | 3 | 9.8.43 | 234 | 2986 | 13½ |
| 280 buff. | Bunni | 2 | 2.12.42 | 485 | 3750 | 13½ |
| 254 „ | Arimal | 4 | 1.7.43 | 273 | 3410 | 15 |

### *Trivandrum cattle*

Travancore State. Two cows completed their lactations during April 1944 yielding 4,625 lb. and 3,960 lb. respectively.

## REASONS FOR KEEPING MILK RECORDS

FOLLOWING are some convincing reasons, universal in their application, for keeping records of daily cows and which are of first importance to every-one who milk cows for a living.

(1) Milking records constitute a guide for the feeding of each cow according to the quantity of milk she produces. Records stimulate better feeding and breeding. The dairy farmer who keeps records usually feeds a balance ration and becomes interested in winter feeding, and so maintaining his milk supply throughout the year.

(2) The weighing of the feed and milk keeps the dairymen in close touch with the daily condition of each cow ; ill-health is thus readily observed.

(3) Milking records form the only basis on which a herd can be improved.

(4) No careful dairy farmer will buy a bull for use in his herd whose dam has not an authentic record ; showing creditable milk and butter-fat production.

(5) Records alone will sell cows when no other quality will. Grade cows with records can be sold from 25 to 50 per cent more than those for which there are no milking records.

(6) A system of records is the first step in building up a herd. Unprofitable cows are the most expensive : their heifer calves are usually low producers and should not be kept for the milking herd.

(7) Records also stimulate better milking. Milk scales serve as a check on the milker and induce him to milk more thoroughly than when the milk is not weighed. A knowledge of what each individual cow is doing develops personal pride and interest in the herd.

(8) Finally, records make dairying a business proposition and, in various incidental ways, mean more money to anyone who milks cows for a living. A maxim which should be prominently displayed in every milk shed is—'The cow, not the herd, is the unit of profit'.

—*Dairy News Letter*, Canada, April, 1944.

# PROSPECTS FOR SOIL CONSERVATION

By G. V. Jacks

*Deputy Director of the Imperial Bureau of Soil Science, Rothamsted Experimental Station*

DURING the last century wherever new land has been opened up for settlement, there have been practised kinds of agriculture which have resulted in a depletion of the natural fertility of the soil. Soil-depleting agriculture is almost invariably the rule when land is first settled, and there is nothing particularly blame-worthy about this latest world-wide appearance of it. But a remarkable feature of recent settlements has been the rapidity with which symptoms of soil exhaustion have appeared after a country has been opened up. The first symptoms are failing yields, which nobody bothers much about, because they are expected. A later and quite unexpected phase of soil exhaustion has been not a further gradual diminution of yield, but the more or less complete disappearance of the soil itself. It is practically impossible to reduce the crop-producing power of soil to zero however exhaustively it is cultivated, but it has been found that long before complete exhaustion is approached, the soil loses its capacity for remaining in place. A fertile soil, wherever it is formed has many of the properties of a sponge—it can absorb quantities of water, and possess considerable internal cohesion. An infertile or exhausted soil loses this water-absorbing capacity and cohesiveness, and breaks down to a mass of separate particles, in which condition it is very readily washed away by water or blown away by wind.

In this way, as a result of the depletion of a mere fraction of the total soil fertility, enormous areas, mainly in North America, Africa, and Australia, have been denuded of soil and are now to all intents and purposes barren wastes. The current wastage of land through this so-called soil erosion is not immediately serious for the world as a whole, since there is still plenty of good land for everybody, but it is becoming serious in certain countries, notably the United States and territories in South and East Africa. It was stated a few years ago that at the then rate of erosion the United States would be incapable of organized existence by the end of the century. For much of Africa, where erosion is a more rapid process, the end of the century would be an optimistically distant date for the end of human dominion over the land.

Summary figures of a national survey made in the United States in 1934 illustrate the extent of the damage done by soil erosion, mainly within the last 40 years. Of the total land area 14 per cent had lost three-quarters to all of the soil, 42 per cent had lost one-quarter to three-quarters of the soil, and 30 per cent (much of it unsuitable for agriculture) was uneroded. Apart from the loss of productive soil, incalculable damage has been done by chronic flooding of the main rivers, progressive dessication of the land, and the profound disturbances to the normal regime of ground waters that are produced by the disappearance of the absorbent surface soil and adversely affect agriculture even where no erosion has occurred. The process of erosion, once started, proceeds under its own accelera-tion in ever-widening circles. It works insidiously striking at the base of social existence while leaving the main superstructure of society untouched. For this reason it never has been, and probably never will be, taken in hand by the community as a whole until it has reached an advanced stage at which the threat to the superstructure becomes apparent.

The cause of soil erosion is often given as the destruction of the natural vegetation which normally affords the soil adequate protection from the erosive action of rain and wind. This is correct up to a point, but there is no reason why the destruction of the natural vegetation, whether forest or grassland, should necessarily be harmful. All agriculture involves such destruction, and it stands to reason that no permanent agriculture is possible where the soil is progressively deteriorating. The real cause of erosion is the practice of an agriculture which does not take full account of the natural

limitations of the environment and causes soil exhaustion which is the invariable precursor of soil erosion, even when stripped of vegetation, and the only certain cure for soil erosion is to utilize the land in a manner which maintains, and preferably increases, its fertility. Such a type of land utilization is general in the highly farmed countries of Western Europe, where, despite prolonged and intensive agriculture, the soils are probably now capable of greater and more sustained production than at any previous time. The agriculture of the Middle Ages was, like the present day agriculture of much of the New World, soil-exhausting, and might ultimately have caused widespread erosion had it not been put on an entirely new basis by the agricultural revolutions of the 17th and 18th centuries. These resulted in a type of agriculture that, so far as the maintenance of soil fertility was concerned, made the optimal use of the natural qualities of the environment.

In the eroding countries of the New World a comparative harmony between agriculture and the environment does not exist; erosion is, indeed, the most common physical symptom of an absence of such harmony. In these countries the evolution of agriculture has been governed by opportunities—by the potentialities rather than by the limitations of the environment. The latter, however, are now making themselves felt. Nature imposes her own harsh discipline on those—whether man, animal or plant—who cannot or will not play their allotted part in preserving the biotic equilibrium which assures the continuing fertility of the earth. Elimination is the invariable rule in such cases, and soil erosion is a very effective way of eliminating man. Agriculture must either develop into a process that increases the fertility of the soil, or cease altogether. The factors, chief among which is the climate, that determine how the soil must be cultivated so as to increase its fertility are still largely outside human control.

On the other hand, the factor which determines how the land actually is utilized is primarily economic. In general, men will always cultivate the land in the way that gives them the greatest economic advantage, and soil-exhausting agriculture, which implies drawing on the existing fertility reserves, tends to be easier and more immediately profitable than soil-conserving agriculture, which implies investing something in the land to pay a dividend at a later date. Consequently, although the measures required to stop soil erosion and build up soil fertility are simple and understood everywhere, they are now applied on a scale commensurate with the task unless and until the economic conditions of a country make it more profitable to conserve than to exhaust the soil. The first essential step in the soil-conserving agricultural revolution in Britain—the enclosure and pasturing of exhausted arable land—was promoted by the prosperity of the wool trade and the contemporary depression of the grain trade. In recent years one country—the United States—has apparently turned the corner from soil exhausting crops. The Agricultural Adjustment Administration was set up to reduce the acreage of these unsaleable crops, it has survived many vicissitudes to become a powerful agent in encouraging the cultivation, in their place, of soil-conserving crops. American economy is developing along the lines which are making it more profitable to make than to destroy soil fertility. Provided future developments are in the same direction, the problem of soil erosion will solve itself.

These developments are towards a more self-sufficient economy than has prevailed hitherto. As agriculture becomes self-sufficient the limitations of the natural environment assume a much greater importance than they possess in a period of expansion. The countryside begins to take on an appearance dictated by the qualities of the land, and human society a form which harmonizes with the environment. Permanent agriculture is established and civilization has a chance to develop on a secure foundation. Already we can trace in the United States the emergence of new cultural patterns representing the landscapes of permanent, soil-conserving agriculture. Associated with these patterns there is emerging also a new form of society that is based on the community as the ultimate social unit and rejects the 'rugged individualism' which was such a marked feature of the pioneering era. It has been proved beyond doubt that the individual, working by and for himself and in open competition with his fellows, is incapable of preserving the fertility of the prairie environment; sooner or later, he must destroy the soil in the struggle to maintain his position in society, whereas a cooperating community of farmers acts spontaneously in such a way as to preserve its social base, the land. Unstinted cooperation between

occupiers of land is now recognized as so vital to the success of any scheme for soil conservation that the Federal authorities refuse their essential assistance unless cooperation is assured. What cooperation means at the present time—a very embryonic stage in the evolution of permanent agriculture—is that while the owner retains full legal title to his land the community of which he is a member decides how he shall utilize it; and unless the community decides that the land shall be worked so as to conserve its fertility, the very existence of the community itself is threatened.

The necessary requisites for the accomplishment of soil conservation in an eroding region are thus, firstly, an economic system under which it is more profitable to make than to destroy soil-fertility, and second and complementarily, a form of society that can work the economic system. Given these—they are complex functions of the environment—permanent soil-conserving agriculture follows automatically. There is nothing particularly difficult about the technique of permanent agriculture, but the conditions which make its application generally acceptable must obtain. In Britain they have obtained for so long that soil conservation has become the primary concern of agriculture, and not all the outcry for super-efficient farming can shift the deeply rooted instinct of the community to preserve the soil intact. In the United States favourable conditions, first created by the world-wide economic depression, are just beginning to appear. Thanks partly to the neglect of British agriculture and partly to their financial indebtedness to the Mother Country the main agricultural regions of the British Empire retained their overseas market after the agricultural depression, and have continued to export large quantities of the produce and fertility of the soil. The economic incentive to exploit the soil has been too great to be resisted.

It is doubtful indeed whether agriculture can ever become conservative so long as the farmer is concerned with adapting his practices more to the requirements of a foreign market than to the limitations on land utilization imposed by Nature. In other words, a large measure of self-sufficiency is indispensable to the establishment of permanent agriculture. This is what one would expect on theoretical grounds, and it is fully borne out by recent experience. The United States owes the salvation of its soil to the disastrous breakdown of international trade; other eroding countries may survive to thank the grim economic aftermath of the war for affording the opportunity to reorganize their agriculture on a stable and enduring foundation. It is at least certain that a heavy price is owing for soil exhaustion, but the sooner payment is enforced the less onerous it will be.—*The East African Agricultural Journal*, October, 1942.

## PHOSPHORUS IN SOIL

SEVERAL workers have shown that the amount of phosphorus available to plants is increased after the application of lime or limestone to the soil. This benefit from lime has been found to be appreciable even when superphosphate has been used as fertilizer. Superphosphate contains calcium (the active element in lime, limestone, and chalk) and this calcium is largely in soluble form; so also is the phosphate in super. The old theory was that the value of superphosphate as a source of phosphate for plants was due to the fact that phosphate had been converted into a soluble form which the plants could take up readily. To add lime with the super would offset this benefit, and was discouraged. We now know that when phosphate in water-soluble form is added to soil, most of the phosphate combines with soil constituents to become at least temporarily insoluble in water. This immobilization or 'fixing' of phosphorus by the soil, which results in the phosphate becoming unavailable or only slowly available to plants, partly arises from the formation of phosphates of iron and aluminium, which are practically useless to plants. It has been suggested that lime somehow decomposes the iron and aluminium phosphates, though it is not clear how that could occur. Two Indian workers, M.O. Ghani and S. A. Aleem, of Dacca University, have shown that when slaked lime, chalk, magnesium oxide or gypsum was added to portions of an acid soil kept under laboratory conditions, the amount of phosphorus that could be supposed to be available to plants increased. The effect of the added materials in increasing the amount of available phosphorus persisted for some weeks. There was practically no effect upon the insoluble phosphates and it appears that the increased amount of available phosphate had been principally derived from the organic phosphorus such as is present in the tissues of fungi and remains of higher plants. This in turn suggests that

the effect of the added materials was a stimulation of the activities of the soil microbes, and particularly the bacteria. In the presence of lime, chalk, etc., bacteria were able to complete the decomposition of organic matter and to bring its locked-up phosphorus into a form which plants can assimilate.—*Monthly Science News.*

## TEACHING TREES TO FEED THEMSELVES

WAREHAM HEATH is as uninviting a tract of Britain for growing anything as can be found. It is the 'Egdon Heath' of the Hardy novels, and Thomas Hardy used its austere unproductiveness to express an unchangeability that even the hand of man was powerless to alter. Today it is being altered by the hand of man, or rather through the researches of a woman scientist, Dr M. C. Rayner.

She based her work on the researches of Professor A. B. Frank, a German scientist commissioned by the German Government in 1882 to inquire into the production of truffles. Frank discovered very little about truffles, but he did discover that a wide range of trees have a fungal development in or around their roots. This fungus, it is now thought, is involved in the decomposition of particles of vegetable and animal matter in the soil, and, by its intimate association with the roots, supplies trees with essential food materials. This feeding process takes place in the 'short roots' or tiny lateral rootlets that are quite distinct from 'root hairs'. The relationship can take two forms. In one, the rootlets are enveloped in a sheath-like covering of fungal threads, some of which penetrate the root tissues. In the other, the fungal threads actually live inside the rootlets, without forming an external covering ; some tree species have one form, some the other.

A number of the fungi involved in this vital association are closely related to the ordinary mushroom. Thanks to Dr Rayner, we have learnt now that this method of making use of the fungus in the soil is the most important way in which a tree gets its food ; and in a soil as difficult as that at Wareham Heath it is essential if the tree is to thrive. The difficulties there are many. Exposure is severe, large parts of the heath are difficult to drain, and the soil is not only extremely infertile but is actually poisonous in its untreated state to the growth of beneficial soil fungi.

Dr Rayner's problem was how to improve the soil conditions so as to permit the development of these fungi. She experimented with various composts, the best of which so far is one made with brewery hop waste and dried blood : another satisfactory one is straw and dried blood. Other materials being experimented with are bracken, heather and sawdust. Artificial manures such as sulphate of ammonia are no substitute for the compost, for they tend to prevent fungal growth. Some of these fertilizers, superphosphate for example, have proved fatal to the trees. By using suitable compost, however, trees are growing on Wareham Heath with complete success.

In the experimental plot, I saw both Scots and Corsican pines, the seed of which was sown with compost, that were robust, vigorous in growth and about 15 ft. high. Beside them were spindly weaklings, sown without compost on the same day, whose height could be measured in inches.

Britain is already leading the world with this new knowledge gained at Wareham Heath, but now further progress is being made. It is an expensive business to compost a whole forest, so they are trying the effect of composting the seed beds in a nursery on the Heath and then planting the trees out without further treatment. So far this is succeeding. Plants grown on compost-treated soil and then put out on the sterile soil of the Heath are flourishing, while those planted out beside them, grown in an ordinary nursery without compost, are a pretty sorry sight. In fact, better results are being obtained on the infertile Heath soil by using Dr Rayner's methods than on normal agricultural soil.

It would appear that if the seedling learns in the nursery how to forage for itself by developing these rootlets for entering into fungal association with the soil, it retains this habit through life and converts food to its use even in soil conditions as bad as those at Wareham. This means an immense saving of expense and labour, for it would only be necessary to compost a few acres of forest nursery instead of thousands of acres of forest.

The experiments are too new to say where they will lead us. They may revolutionize our ideas throughout the whole realm of plant growth, or they may only apply to some kinds of trees on some kinds of soils. Certainly they seem to have solved the problem of Wareham Heath and it will be more than remarkable if Wareham is the only place where they apply.

Will they enable us to get better results in tree-growing in other places where afforestation is difficult—on the chalk downs, for example, or on some of the moors ?

Dr Rayner emphasizes that her work only concerns trees. But shall we find that this principle of root and fungus reaction extends far more widely through the vegetable kingdom ? Will it enable us to grow better and healthier farm and garden crops ? Is it yet another reverse for the school who believe that doping the soil with chemicals is the way to compel nature's cooperation in food production ? —*News Chronicle* (London).

## ARTIFICIAL INSEMINATION IN THE U.S.A.

AMERICAN farmers in general, and those in the Great Lakes States in particular, have made a marvellous record in production, largely because they have been alert to the advantages inherent in the new findings coming out of agricultural research and technology.

On 1 January, 1943, we had ten cooperative dairy cattle breeding associations in Wisconsin which were serving nearly 50,000 cows. These associations are bringing about rapid herd improvement through the medium of artificial insemination. It would be difficult to find an equal number of bulls as good, even if you were to comb the entire United States, as the hundred in service in these associations.

This application of science is contributing to the war effort in more ways than one. In the first place, approximately 3,000 bulls, formerly maintained by dairymen who are now members of these breeding associations, have been sold, and the space in the barns that they formerly occupied is now being filled by more than 5,000 milking cows. These additional cows are annually producing at least 30 million lb. of milk.

In this connection it is significant that each veterinarian employed in this artificial insemination project actually makes possible an increase of 1,000,000 lb. of milk annually, simply in terms of the output of the cows that have replaced the bulls formerly required in the herds making up the breeding associations. The bulk of the 3,000 discarded bulls should never have been used for breeding purposes.

But by far the largest benefit from this artificial insemination project is the improvement in the productive ability of the offspring of these 100 superior sires when compared with that of the cows now in the cooperating herds. It is not too much to expect that the heifers sired by these outstanding bulls will produce from 15 to 20 per cent more milk and butterfat than their dams. These better young cows in the herds of the association members will not only add to the supply of badly needed dairy products during the war period, but they will also be of tremendous advantage in the post-war period. Their improved production and greater efficiency will help farmers better to cope with economic conditions that follow the war. This improved breeding stock will also help provide needed replacement for the depleted and destroyed herds of continental Europe.—*Farm Implement News*, Chicago.

## CARE OF EGGS DURING THE SUMMER MONTHS

WITH the advent of warmer weather the care and handling of eggs requires much greater attention if the quality is to be retained. Without proper care of the eggs, much of the time and energy used to increase production will be wasted.

Many of the factors which help to reduce deterioration in the new laid egg can be controlled by the operator, says J. B. O'Neil, Poultry Division, Central Experimental Farm, Ottawa. The frequent change of nesting material will help to reduce dirty eggs to a minimum. Eggs which become soiled may be cleaned with a damp cloth or an abrasive such as steel wool, but these methods tend to remove the bloom from the egg, making them less attractive in appearance. Any eggs which are very dirty should be kept on the farm for home consumption, and not sent to market. The eggs should be collected frequently and put in a cool moist place without delay or they will quickly drop in quality. The extra labour involved in collecting the eggs four or five times a day is more than offset by the extra dividends from a higher quality product. Wire baskets are ideal for the cooling of eggs as they allow the air to circulate between the eggs. Temperatures of around 50 degrees and a relative humidity of about 75 per cent are nearly ideal for storing eggs. Higher temperatures will cause excessive evaporation and too high humidity encourages mould growth.

As eggs have a tendency to absorb odours, they should be kept away from such things as

kerosene. The frequent marketing of eggs is advisable for there is a loss in quality even under the most favourable conditions.

To carry out these suggestions may involve a certain amount of extra labour, but it will pay. When the spread in price between grade A and grade C eggs is considered it is evident that the extra care in handling is very profitable.—*Press Note, Department of Agriculture,* Canada.

## HOW TO PREVENT NATURAL SWARMING

SWARMING is the bee's method of making increase, but if allowed it is at the expense of the honey crop and is always accompanied with the possible loss of the bees themselves.

Since swarming usually occurs just prior to or during the gathering of the main honey crop and as maximum honey production should be the aim of every beekeeper it is important that the swarming instinct be suppressed by every means possible, says C. B. Gooderham, Dominion Apiarist, Central Experimental Farm, Ottawa.

One method which has proved efficient is to separate the queen and brood, but retaining both within the same hive. This method is generally known as the Demaree plan and consists of nothing more than raising all combs containing brood from the brood chamber to a super on top of the colony and leaving the queen below on a new set of empty combs.

During the early summer, shortly before the main honey flow commences, apply the treatment to all strong colonies as a measure for suppressing the instinct. First find the comb on which the queen is working and set it aside and then take out all combs containing eggs and brood and put them in a super. Replace the moved combs with a new set of empty ones, and transfer the queen to them. Place a queen excluder over the chamber now containing the queen and on top of the excluder put a honey super and on top of it set the super containing the brood. The colony is now at least three stories high ; the lower story contains the queen, the second is for the storage of honey, while the third contains the brood, thus the colony is in a condition similar to that of a newly hived swarm.

On the seventh day after treatment, examine the raised brood combs carefully and destroy all queen cells that may have been started.

The plan is also successful when applied to colonies that already have made preparations for swarming. The only difference in procedure is that all queen cells must be destroyed at the time the brood is raised and again seven days later.

While the plan outlined is highly recommended as a swarm preventative measure it is necessary to point out that by itself it is of little value, in so far as the ultimate honey crop is concerned, unless preceded and followed by other efficient management.

Write to the Bee Division, Central Experimental Farm, Ottawa, for 'Instruction Sheet' Bee 1, if further information on Swarm Control is desired.—*Press Note, Department of Agriculture,* Canada.

# New Books and Reviews

## AGRICULTURAL CO-OPERATION IN INDIA

By KHAN BAHADUR NIZAMUDDEEN HYDER, (Shukla Printing Press, Lucknow, pp. 14 as. 8)

THE AUTHOR, a former Director of Agriculture in the Nizam's Dominions, has taken up the task of examining in this small pamphlet the vicissitudes of the cooperative movement in India. The pamphlet is divided into four sections: (1) introduction, (2) cooperative credit activity - a failure, (3) change-over to non-credit work, and (4) multi-purposes' societies.

In the introduction he quotes Sir John Russell: 'The outstanding instance of success in cooperation is Denmark, a land of small farmers; and it has given them a standard of living that is the envy of the civilized world.' But he fails to take note of the fact that social, economic, climatic and other conditions here are quite different from those in Denmark and other Western countries.

It is quite true as Sir Malcom Darling's report says that 24 per cent of the total number of societies started since the beginning of the movement have gone into liquidation, but that need not detract from the value of the remaining 76 per cent that are in existence and are doing service to the tenantry. Like other socio-economic activities cooperation has also to make experiments. Some failures are bound to occur. In a country like England, well advanced in education and social consciousness the Rochdale Pioneer had to be liquidated and re-registered no less than six times. Failures are often the pillars of success.

What is the data to prove that 80 per cent of the cooperative societies in existence are in an unsatisfactory condition, as suggested by the author? It is a very sweeping statement. It would be too much to say that the co-operative movement is an unpopular one and can never succeed? If the movement came into disrepute in Burma, Bengal and Bihar, instances can be multiplied from the Punjab, Madras, Bombay, United Provinces and other parts of the country with very much a different story to show how the economic life of the rural areas have considerably improved under the beneficent influences of the cooperative movement.

The success of the cooperative movement in India does not depend on cheap credit alone but on better living, better farming, better business and better banking. In spite of serious economic, social and climatic handicaps there are tracts in which even credit societies have achieved a fair measure of success. The success of the cooperative movement as a whole however depends upon social, educational and economic advancement of the country. This is a stupendous problem and cannot be achieved in the twinkling of an eye. When the first Act was passed in 1904, the late Mr Gokhale was pleased to remark on the floor of the Council that the success of the cooperative movement depends upon a more liberal policy of education.

The author suggests a change-over to non-credit work and questions the advice given by cooperative workers to peasants to practise thrift or to cut down the ceremonial expenses which in their opinion are unproductive, because he thinks that cultivators have very little to save and are under obligation to feed their brothers in caste on a few ceremonial occasions. To some extent this may be true because agriculture was not a paying industry and the cultivators are poor. But at the same time it can hardly be disputed that the Indian ryot in spite of his poverty has been spending money on these ceremonial occasions much more than what he can possibly afford. It is only through the cooperative organizations of social *panchayats* that he has to be taught the virtue of thrift.

Even at present when the prices have gone up considerably high, the cultivators have failed to improve their economic condition due to lack of education and thrift. This has no doubt led the Government to introduce Defence Bond contributions among the cultivators to prepare them for the inevitable depression that must follow the close of the war—a thing which they must be taught to foresee.

As regards obtaining better prices by grading produce it may be remarked that on account of their poverty the majority of villagers cannot afford to pay higher prices for the graded articles. These suggestions must therefore remain a dead letter with the rural masses for a long time to come.

The multi-purpose societies suggested by the author are already in existence in the United

Provinces. They not only arrange for marketing of produce but also arrange for the supply of other agricultural requirements such as seeds, manures, implements, etc. Besides there are societies that deal with daily requirements such as cloth, salt, kerosene oil, sugar, etc.—J.P.S.

## PEAT HELPS APPLE TREES

APPLE trees too often make weak growth the first year planted and this failure of apple trees to get off to a good start has become a problem of increasing concern to apple growers. The use of granulated peat moss or granulated sphagnum moss mixed with the soil in the hole at planting time has given very beneficial results at Ottawa, says D. S. Blair, Division of Horticulture, Central Experimental Farm, Ottawa. The growth from trees planted with a mixture of peat moss has been greater at the end of the first growing season than where trees have been planted with soil alone. This early strong growth has more than justified the extra expense involved.

The peat moss should be well soaked before using and is mixed with the soil at the rate of one part to four parts of soil by volume. The more thorough the mixing of the soil and peat moss the better the results. It is preferable to fill the hole from bottom to top with this mixture rather than place it in the bottom of the hole around the roots as this provides a more or less open soil from the surface to the roots.

The benefits from the use of peat moss are many. First, it provides better aeration and the roots are able to get more oxygen in the early part of the season, which makes for more rapid root development. Second, the peat moss is more retentive of soil moisture than soil and the roots are assured of a plentiful supply of soil moisture after planting. Third, the porous nature of the soil around the roots permits easier penetration of rain water to the area occupied by the roots and less run-off of surface water. Fourth, due to porous type of soil roots can develop more readily.

Because of the boost that peat moss gives to apple trees following planting, all growers are urged to make its use a standard orchard practice.—*Department of Agriculture*, Canada.

# From All Quarters

## BIRTHDAY HONOURS

This year's Birthday Honours list includes several names connected with services to agriculture and animal husbandry.

*To be Knight Companions of the Order of the Indian Empire.*

Sukumar Basu, Esquire, O.B.E., Indian Civil Service, Secretary to the Government of Bengal, Department of Agriculture (late Secretary, Imperial Council of Agricultural Research.)

*To be Officers of the Order of the British Empire.*

Rai Bahadur Nepal Chandra Sen, Officiating Secretary, Department of Agriculture, and Agricultural Development Commissioner, Bengal.

Ronald Curtis Woodford, Esquire, Director of Agriculture, Assam.

*To be Members of the Order of the British Empire.*

Sailesh Chandra Roy, Esquire, Assistant Agricultural Commissioner with the Government of India.

*Khan Bahadur*

Khan Sahib Maulvi Shaikh Abdullah, Deputy Director of Agriculture, Bengal.

*Rao Bahadur*

Sri Percival Venkataramayya, M.A., B.Sc. (Edin.), Principal, Agricultural College, Coimbatore, Madras.

*Khan Sahib*

Maulvi Muhammad Fazlul Karim, Assistant Agricultural Development Commissioner, Bengal.

*Rai Sahib*

Dr Uma Shankar Sharga, Ph.D.(Edin.), F.R.E.S. (Lond.), Assistant Professor of Zoology and Entomology, Agricultural College, Cawnpore, United Provinces.

*Rao Sahib*

Janardhan Vishnu Takle, Esquire, Extra Assistant Director Incharge Animal Husbandry Section, Veterinary Department, Central Provinces and Berar.

Moolayil Joab Simon, Esquire, Secretary, Indian Coffee Board, Bangalore.

## IN TEN YEARS

MR S. B. BETIGERI of Marewad, a village in Dharwar taluka of Dharwar district is a shining example of a silent worker whose efforts have added materially to the food resources of the country. During his minority the farm which he inherited was managed by his mother and uncle and was cultivated according to ancient custom and without any improvement. Out of the 67 acres of the farm, *kharif jowar* was grown on 20 acres, wheat on 15, *udid* (*kharif*) and gram (*rabi*) on 5 and cotton on 27 acres. The yields per acre were of the order—*kharif jowar* 1000 lb., wheat 250 lb., *udid* (*kharif*) 325 lb., gram (*rabi*) 200 lb. and cotton 300 lb.

Mr Betigeri took over the direction of his farm 10 years ago and by dint of hard work and constant effort during this period he has increased its productivity and made a substantial contribution to food production. Out of the profits of Rs. 8,000 during this period Mr Betigeri has purchased 17 more acres for his farm. The present cropping of the 84 acres of the farm is *kharif jowar* 26 acres, wheat 26, *udid* (*kharif*) and gram (*rabi*) 6 and cotton 26 acres. As a progressive agriculturist he has not only introduced all possible agricultural improvements on his own farm but has set an example to his neighbours. As a matter of fact largely through his efforts, improved methods of cultivation and *bunding* have been taken up in the village in large compact blocks. The use of iron furrow-turning ploughs has become a routine agricultural practice. Compost making has been introduced on a large-scale to supplement the farmyard manure, so important for increasing crop production. Mixed and double cropping have been adopted by the village.

As a result of these improved practices, the yields per acre in 1942-43 was raised to the following figures : *kharif jowar* 1,600 lb., wheat 400 lb., *udid* (*kharif*) 554 lb., gram (*rabi*) 315 lb., and cotton 450 lb. Thus the yields of *jowar* and wheat have been increased by 60 per cent, *udid* by 70 per cent, gram by 57 per cent and cotton by 50 per cent. The total quantities of the different foodgrains produced by Mr Betigeri in 1942-43 were — *jowar* (*kharif*) 41,600 lb., wheat 10,400 lb., *udid* (*kharif*) 3,324 lb., and gram 1,890 lb. Whilst these quantities provided food for 100 people, in addition to his family of six, the great value of his work was the example which he set to his fellow farmers. The impetus which he thus gave to the 'Grow more food campaign' was an instrument of raising the standard of production in the village to such an extent that it is estimated to have raised the food supply for about 10,000 people, besides meeting the requirements of the village population of 1,000 persons. Not content with improving his own lot, Mr Betigeri has interested himself in the economic uplift of his neighbours by cooperative effort and, in consequence, the village has been selected as an all-out cooperative and rural development centre.

In brief, Marewad which was, like any other village unit, of small significance 10 years ago, has now become a progressive centre for nation-building activities so largely due to the initiative, enterprise and determination of a single individual.—*W. J. Jenkins, Director of Agriculture, Bombay.*

## HEDGING

A WRITER in *Indian Farming* said that the only hedge worth looking at was *kikar*. Perhaps he was right, especially when he was dealing with a droughty country, and his interest is evident from the emphasis he laid on drought-resistance. But that is not the only suitable hedge ; *Prosopis juliflora* is quite as good. Its stems and branches are weak as compared with *kikar*, but if from the first the branches of one plant are interlaced with those of the neighbouring one, the result in course of time will prove formidable. It is the case with this as with all hedges. Maintenance must be looked after, especially in the early years, and can never be entirely neglected. But one does not plant hedges without something to protect and the expense is not much in cash, but more in grey matter and attention.

Another prosopis that is not usually thought of in connection with hedges is *Prosopis spicigera* the common jungle *khejra* tree which again is very drought-resistant. It has not the same degree of resistance that is reserved for *karil*, *wan* and *jhand*. But it is in the next class. Anyhow it is good enough for use where cultivation is at all possible. The idea of using it as a hedge plant came from seeing one in a garden where the owner had had it trimmed to imitate a cypress, and very close looked the imitation, especially in the hot weather when the tree had its new suit of leaves. But what suggested itself as a hedge tree was the memory it recalled of Provence, where the cypress is so extensively used as a wind-break against the mistral. At the time there was much talk about starting fruit gardens, and the official pamphlets laid great emphasis on the use of *neem* cakes and windbreaks, which immediately suggested the *khejra*. This as a matter of fact will be superior to the cypress, as it has a much less restricted diameter, and can be trimmed not into cigar shapes but into slabs, with the faces at right angles to the *luh*, whose direction is not very variable.

All kinds of things were employed in these experiments, even oleander and roses. The strangest story is that of the thorny bush known as *Acacia cisalpina*. This was first seen on the edge of a garden on the south end of Queensway, New Delhi. From there it was traced to the Government gardens at Jorbagh. As a hedge plant it has no great merits. It is formidable enough with its thorn-back leaf-ribs and its thorny seed cases, but its drought-resistance, though greater than one might expect, is inferior to many other trees (it is not a tree, but a creeper which will run up a tree rather quickly, and in the absence of a tree is procumbent). Further its habits of growth, when used as a garden hedge, where drought-resistance is unimportant, makes it occupy an inconveniently large space so that one cannot recommend it. But the strangest thing is its later history. It is very prolific and begins seeding at an early age. For a long time the seeds dropped to the ground and either sprouted up there or were washed downstream and sprouted elsewhere. But of late it has been noticed that no seeds are to be found, and that at their ripening seasons the bushes are much infested by gleaners from neighbouring villages. And the utmost search fails to disclose a seed. The fact is that a Yunani practitioner taking the core of these seeds as a

base and mixing it with black pepper and making pills the size of *jowar* seeds, prescribed them to his patients as a remedy for malaria and a disease locally called *badi*. No doubt the seeds are now being planted in favourable positions, and some day we shall have supplies of our own : meanwhile we may have decided against *Acacia cisalpina* as a hedge plant.—*Kashtkar*.

## DERRIS ELLIPTICA

ROOTED derris (Tuba Malaya) cuttings are available in India for cultivation. Mr P. Kurian John, Manager of Kallar Valley Cardamom Estate, Kottayam, Travancore, obtained rooted cuttings of the plant from Mudon station, Burma, before the war and planted them in different places, viz. near the river side, on laterite hilly soil and also at an elevation of about 3,500 ft. to 4,000 ft. in the High Range. The plants are growing quite satisfactorily and in some cases shoots are available for cuttings. He is of the opinion that this plant could be grown in any good alluvial soil with sufficient moisture, from sea-level right up to about 4,000 ft. But it takes not less than two years from planting to obtain the tuber roots for the preparation of insecticides the proprietary article of which is sold by the Imperial Chemical Industries, Ltd. under the name of 'Derrisol'.

Those interested in the cultivation of the plant may correspond direct with Mr P. K. John, who will be willing to send them the cuttings of the plant for cultivation at a reasonable price.

## I D R I POST-GRADUATE COURSE

APPLICATIONS are invited for the next 15 months' Post-graduate course in Dairy Husbandry and Dairying commencing from the 10th January 1945. Distinguished graduates of Agricultural and Veterinary Colleges, and selected officers of Agricultural and Veterinary Departments and Indian Dairy Diploma holders are eligible for admission. Completed applications should be addressed to the Dairy Husbandry Officer, Imperial Dairy Research Institute, Bangalore, through the Director of Agriculture or of Veterinary Services of the province or state in which the applicants are residents, to reach the Dairy Husbandry Officer, on or before the 10th November 1944. The Post-graduate training is now recognized by the Government of India for Associateship.

Further particulars and form of application can be had immediately on application to the above address.

# INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

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# INDIAN FARMING

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## COMMODITY COMMITTEES

THE establishment of the Indian Central Cotton Committee in 1921 as a result of the recommendation of the Indian Cotton Committee of 1917-18 and its subsequent incorporation under the Indian Cotton Cess Act, 1923, has been one of the landmarks in the history of Indian agriculture. It represented the establishment of the first private organization possessed of a permanent and independent source of income and entrusted with its expenditure for the special purpose of the improvement and development of the growing, marketing and manufacture of one of the chief agricultural products in India. The aims of the Committee are to supplement the cotton work of provinces and states and to assist in guiding and carrying through a coordinated policy of cotton improvement throughout the country.

The constitution of the Committee provides for wide representation. Its membership, exceeding 50, includes agricultural and economist officers of the Government of India, representatives of provincial and state Departments of Agriculture, cooperative banks, Chambers of Commerce, Millowners' Associations, the cotton growing industry, the ginning industry and the manufacturer. As *ex-officio* President, the Vice-Chairman, Imperial Council of Agricultural Research, acts as an important connecting link with the Centre. The outstanding success which has attended the work of this Committee during the two decades of its existence is attributable in a large measure to the greater understanding of the problems and requirements of each aspect of cotton production which its representative membership has made possible. The broad outlook, it has ensured, is reflected today in the wide-spread advantages which the grower, trader, spinner and manufacturer have derived and which the constant association of business interests, growers as well as research workers, has made possible.

On the agricultural side, the Indian Central Cotton Committee normally works through provincial and state Departments of Agriculture to which it gives financial assistance for the investigation of special problems or the conduct of particular pieces of work. On the research side, it has been largely responsible for the introduction of many improvements in the yield and quality of Indian cotton, in the discovery of ways and means of combating insect pests and fungal diseases, in the better understanding of the physiology of the cotton plant and in increasing the income which the grower derives from this crop. On the developmental side, the Committee had done much to repair the neglect which existed widely through the failure of the provinces and states to provide the grower with an adequate supply of seeds of improved strains of cotton. At present, the Committee is operating a large number of schemes of improved seed distribution in most of the cotton-growing tracts of India. On the technological side, the Indian Central Cotton Committee runs its own Cotton Technological Institute.

Similar all-India Commodity Committees were constituted in respect of lac in 1930, coffee in 1935 and jute in 1936. They function generally on the same lines except that, apart from providing assistance to interested provinces, the more recently established Committees, in addition to their technological institutes, have their own agricultural research stations working directly under themselves.

The important part which an independent commodity committee can play in promoting all interests connected with the commodity has been demonstrated so forcibly that it is now recognized that the establishment of similar

committees for each of the important agricultural commodities or groups of commodities, should form an essential feature of the future development of agriculture and animal husbandry in India and the Memorandum on development recently issued by the Advisory Board of the Imperial Council of Agricultural Research regards their establishment as one of the major directions in which the Centre can assist and supplement the work of provincial Departments of Agriculture and Animal Husbandry.

An important feature of these Committees is that each is provided with an independent source of finance derived from a cess or duty at some stage in the preparation or disposal of the commodity. Thus, the Indian Central Cotton Committee derives its funds from a cess on all Indian cotton exported from India or consumed in Indian mills. The Indian Lac Cess Committee is financed by a cess on lac produced in India and exported by sea outside British India. The financial requirements of the Indian Central Sugarcane Committee will be met by the assignment to it annually of a part of the Sugar Excise Duty now levied on sugar manufactured in British India. From the Tobacco Excise Duty an annual provision will be made available for the Indian Central Tobacco Committee. A cess on all crops crushed in Indian mills will provide the necessary funds for the Indian Central Coconut Committee, whilst the Indian Coffee Board obtains its requirements partly from a duty on coffee exported from India and partly from an excise duty on coffee consumed in India.

It is intended shortly to add to the number of these commodity committees an Indian Central Rice Committee and an Indian Central Oilseeds Committee. Others in contemplation may deal with other foodgrains, fibres other than cotton and jute, vegetables, potatoes, fruits, fodders and grazing. Nor are animal husbandry products being overlooked. Though no commodity committee of this nature has been established so far, a committee of interests concerned recently agreed unanimously that an Indian Central Hides and Skins Committee is essential and discussed ways and means of financing it. Other commodities which will be considered in due course include fish, milk, poultry and wool.

The inauguration of this series of commodity committees with their chains of research stations on the agricultural and technological sides when complete, and backed up as they will be by greatly increased provincial activities, will give a new impetus to the improvement and development of agriculture and animal husbandry. They may be expected with confidence not only to achieve much in increasing the production of foodgrains essential to the steadily growing population of the country and in providing for the better nourishment of the people but also in catering more fully for the needs of commerce and industry.

# TRIAL RATIONS FOR CATTLE[1]

FOOD for animals may be subdivided into protein and non-protein parts, and the relative proportion of these (expressed as the nutritive ratio) will vary according to the type of animal concerned. For maintenance purposes the ratio can be fairly wide, up to about 1 : 15, but this must be narrowed for production, as in the case of cows giving milk.

The simplest method of computing rations is to express the total food required by an animal in terms of total digestible nutrients, and the protein part of the ration separately as digestible protein.

If the amount of each of these two moieties, a particular animal needs either for maintenance or for production, is known, and if also the chemical analysis of the feeding stuffs is available, or better still, the amount of total digestible nutrients and digestible protein which the feeding stuffs contain, it should be an easy matter to calculate the amount of feeding stuffs required, singly or in combination, for the purpose in view.

The following four categories may be considered. Standards for each are given below :

1. A mature dry cow of 800 lb. weight getting sufficient exercise to keep it in health requires for maintenance purposes 10·1 lb. of dry matter, 6·2 lb. of total digestible nutrients and 0·46 lb. of digestible protein per day. It should be an easy matter therefore, from the analytical and digestibility data of the feeding

[1] A note for the guidance of District Officers for computing standard or trial rations in their districts.

stuffs available, to determine how much of the latter are required. For the guidance of those having to deal with animals of weights other than 800 lb. the maintenance requirements of an animal do not vary according to the weight, but according to the body surface, and the body surface is proportional to the two-third powers of the live-weights. If, therefore, the maintenance requirement of an 800 lb. animal is known to be 10 lb. of dry matter, the requirements of 1,000 lb. animal will not be :

$$\frac{1,000}{800} \times 10 = 12 \cdot 5$$

$$\text{but } \frac{(1000)^{2/3}}{(800)^{2/3}} \times 10 = 11.76 \text{ lb.}$$

Example of maintenance rations.

| | | Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|---|---|
| *North India* | | | | |
| Wheat *bhusa* | 8 lb. | 7·36 | 3·6 | — |
| Green fodder (Mixture of *juar* and *guara*) | 20 lb. | 3·90 | 3·0 | 0·470 |
| | | 11·26 | 6·60 | 0·470 |
| *South India* | | | | |
| *Cumbu* green | 31 lb. | 6·82 | 4 03 | 0·279 |
| *Cholum* stalks | 4 lb. | 3·64 | 1·72 | 0·124 |
| Rice bran | 1 lb. | 0·93 | 0·54 | 0 060 |
| | | 11·39 | 6 29 | 0·463 |

2. *Standard for the production of 8 lb. of milk a day :* Experimental work in northern India has shown that in the case of Sahiwal cows the amounts of total digestible nutrients and digestible protein respectively required in addition to the maintenance ration to produce 1 lb. of milk with 5 per cent fat per day are 0·357 lb. and 0·048 lb. respectively. Therefore, to produce 8 lb. of milk with 5 per cent fat, 2·856 lb. total digestible nutrients and 0·384 lb. digestible protein will be required.

These figures are in close approximation to, but slightly lower than the corresponding figures obtained for cows in the U. S. A. The total amount of total digestible nutrients and digestible protein needed in the ration of an 800 lb. Sahiwal cow giving 8 lb. of milk a day may be found by adding the figures just given to those given under 1 above.

| | Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|---|
| Maintenance requirements of an 800 lb. dairy cow. | 10·06 | 6·190 | 0·463 |
| For producing 8 lb. of milk containing 5 per cent fat. | 3·30 | 2··56 | 0·384 |
| Total requirements | 13 36 | 9·046 | 0·847 |

Example of rations for an 800 lb. cow giving 8 lb. of milk per day.

| | | Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|---|---|
| *North India* | | | | |
| Wheat *bhusa* | 2 lb. | 1·84 | 0·900 | — |
| Maize green | 55 lb. | 11·55 | 8·250 | 0·550 |
| *Toria* cake | 1 lb. | 0·92 | 0·740 | 0·300 |
| | | 14·31 | 9·890 | 0·850 |
| *South India* | | | | |
| *Cumbu* green | 60 lb. | 13·20 | 7·800 | 0·540 |
| Rape cake | 1·25 lb. | 1·16 | 1·160 | 0·350 |
| | | 14·36 | 8·960 | 0·890 |

3. *Standards for working bullocks performing six hours of work a day :* Experimental data on the requirements of total digestible nutrients and digestible protein for working animals in India have not yet been evaluated as clearly as have the data for milk production. It may be assumed that weight for weight the maintenance requirements of working bullocks are approximately the same as for dry cows. Experimental evidence so far available indicates that an 800 lb. Hissar bullock working six hours a day requires for the performance of the work, over and above the requirements for maintenance, 2·6 lb. dry matter which should contain 1·4 lb. of total digestible nutrients and 0·16 lb. of digestible protein. For other hours of work these figures will naturally be modified in arithmetical proportion. Therefore the total requirements for maintenance and work of an 800 lb. bullock doing six hours work a day will be:

| Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|
| 15·15 | 7·74 | 0·508 |

The necessary ration may therefore be calculated from the feeding stuffs available if

the analytical and digestibility data relating to them are known.

For bullocks of other weights it may be taken that the amounts of nutrients required per hour of work performed are approximately the same, but additional food must be given for maintenance which may be determined as described above.

The above figures may be taken as reasonably accurate for a bullock of the weight and performing the work specified above.

The following rations are given as an example:

| | | Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|---|---|
| *North India* | | | | |
| Wheat *bhusa* | 10 lb. | 9·20 | 4·50 | — |
| Maize green | 23 lb. | 4·83 | 3·45 | 0·23 |
| Cotton seed | 1·5 lb. | 1·38 | 0·85 | 0·27 |
| | | 15·41 | 8·80 | 0·50 |
| *South India* | | | | |
| *Cholum* stalks | 15 lb. | 14·56 | 6·88 | 0·486 |
| Rice bran | 1 lb. | 0·93 | 0·54 | 0.060 |
| | | 15·49 | 7·42 | 0·546 |
| *Cumbu* green | 40 lb. | 8·80 | 5·20 | 0·360 |
| *Cholum* stalks | 5 lb. | 4·55 | 2·15 | 0·155 |
| Gram husk | 2 lb. | 1·86 | 1·06 | — |
| | | 15·21 | 8·41 | 0·515 |

4. *Standards for young growing animals of 200 to 400 lb. weight:* The amounts of total digestible nutrients and digestible protein required by a young growing calf weighing 200 lb. are approximately 5·8 lb. and 0·6 lb. respectively. A typical ration which will supply these nutrients is the following :

| | | Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|---|---|
| Green fodder (Mixture of maize and valvet beans). | 20 lb. | 4·00 | 3·90 | 0·35 |
| Concentrate mixture (Gram 2 parts, bran 1 part, linseed cake 1 part) | 2 lb. | 1·90 | 1·86 | 0·[illegible]0 |
| | | 5·90 | 5·76 | 0·65 |

A young growing animal of 400 lb. weight requires 8·97 lb. of total digestible nutrients and 1·20 lb. of digestible protein and animals of intermediate or higher weights may be fed on a proportionate scale.

Ration for a 400 lb. animal.

| | | Dry matter lb. | Total digestible nutrients lb. | Digestible protein lb. |
|---|---|---|---|---|
| Maize green | 30 lb. | 5·30 | 4·50 | 0·30 |
| Wheat *bhusa* | 2 lb. | 1·84 | 0·90 | — |
| *Sarson* cake | 3 lb. | 2·09 | 2·46 | 0·78 |
| Wheat bran | 1 lb. | 0·77 | 1·11 | 0·12 |
| | | 10·00 | 8·97 | 1·20 |

Officers should realize that the standards indicated above are reasonably accurate, but no standard can be absolute. They will also bear in mind that the analytical data of feeding stuffs will vary from locality to locality according to the time of the year the samples are taken, and according to the stage of growth. These facts should be kept in mind when working out rations from the standards laid down and the analytical data available.

# *Original Articles*

## PRESERVATION OF GREEN FORAGES IN INDIA

By S. Ali Momin
*Animal Nutrition Section, Imperial Veterinary Research Institute, Izatnagar*

THE natural food of farm stock, used for the production of milk, meat or work, is pasture herbage or fresh forage. Green feed is necessary for efficient production and is of special value for growing animals because of its richness in proteins, vitamins and available minerals. Unfortunately, it is only in countries with an ideal climate such as that of the leading dairy districts of New Zealand that pasturage can be obtained for livestock over the greater part of the year.

In India, in spite of the inadequacy of foodstuffs (only 55 per cent of the actual requirement being available) and the serious shortage of good pastures, the organization of reserve fodder is strikingly poor. The present irregular and inadequate system of feeding adversely affects efficiency. Moreover, at present, most of our corn—oats and maize—is required for human consumption. It is necessary, therefore, to provide our animals with more grass and forage preserved in one form or another.

### *Conservation of fodder*

*Artificial drying:* The conservation of crops as dry fodder is primarily concerned with the evaporation of their water content in such a way as to maintain fully their nutritive value while reducing losses to a minimum. This can successfully be effected by properly-conducted artificial drying of the fodder crops. The process, however, involves a large capital outlay and high operating cost and is also too complicated for an average Indian cultivator. Consequently, it is necessary to resort to other methods of conserving forage in the form of hay or silage.

*Hay-making:* The main object in hay-making is to reduce the water content of green plants to such an extent that the hay can be stored without undergoing fermentation or becoming mouldy. Care should be taken to prevent excessive drying, as otherwise a large amount of the feeding value will be lost, owing to the shattering of the leaves.

Sun and wind are the agencies used for drying and although in India these agencies are fairly reliable, seasons vary, and with them varies the quality of the hay made. Hay-making in India requires considerable experience and skill. There are three main causes of loss and damage in hay making which must be avoided as far as possible. These are :

1. Shattering of leaves through excessive handling and drying.
2. Damage from rain.
3. Bleaching due to excessive exposure to the sun, resulting in loss of vitamins.

It must be remembered that the quality of hay produced is more important than its quantity.

*High quality hay:* High quality hay is leafy, green in colour and should be made from plants cut at an early stage of maturity, the stems being soft and pliable. It is free from mould and blight and possesses a sweet, aromatic smell. It should not be either dusty, sticky, moist or coarse. Such hay is much more nutritious and palatable than those deficient in these characteristics.

*Limitations of hay-making:* The successful preservation of legumes and grasses as hay is governed mainly by two factors, viz. (i) the weather and (ii) the stage of maturity of the crops. In India, it is difficult to contend with these factors. Here occurs a period of intense heat, followed by heavy rainfall which in its turn gives place to further dry warmth. During the rains when grass grows rapidly and abundantly, hay making is not possible. The crop, which has seeded some three weeks after the outbreak of the monsoon, will, by October (i.e. nearly four months later), be either rotten and stripped of all foliage or reduced to hard, sapless stems. Hay made from such forage will have very little nutritive value. On the other hand, attempts at hay-making under unfavourable climatic conditions will also entail heavy losses in nutrients. Preservation of grasses as hay does not therefore

promise to be a practical proposition in this country.

### *Ensilage*

It is essential, however, to conserve the surplus grasses grown during the rains for use during the months of scarcity, and their preservation as silage appears to be the most suitable method. Silage-making irrespective of weather conditions should become a popular practice in this country and various Government farms have already practised it with considerable success.

*High protein silage as substitute for concentrates:* Hay is a roughage and can only find a limited use in the ration, particularly in that of the highly productive stocks. It requires to be supplemented by protein-rich concentrates, so as to supply the necessary amount of protein for efficient production. Now that protein feeds are rather scarce, on account of war, substitutes must be explored, though there are very few crops suitable for this purpose. Beans are, however, rich in protein and can be mixed up with a low-protein food in order to form a balanced, productive ration.

High-protein grass silage also fulfils all the requirements of a balanced ration and is, therefore, pre-eminently suitable as winter feed for milk production. Oats, vetch or *lobia* and maize, when harvested at a medium stage of maturity, make good silage. Even ordinary grass, if properly ensiled at an early stage of growth, will produce silage of a high quality.

Apart from the nutrients it contains, good silage is highly palatable, and therefore the stock will usually eat more roughage on the dry basis when fed both silage and hay or other dry roughage than when receiving only dry feed. This will often make possible a considerable saving in the amount of concentrates required for good production.

### *Methods of ensilage*

There are several possible methods of the preparation of silage, which may produce either sour or sweet silage. But for India silage making in pits is most suitable and economical.

*Silo:* The first essential is to dig a silo pit or trench of suitable dimensions. The size is to be computed from the amount required for the daily needs of the farm. A useful average silo is about 30 ft. long, 12 ft. wide and 6 ft. deep with sides slightly sloping. This will hold from 800 to 1200 md. of green grass, yielding from 600 to 800 md. of silage. The pits should be located on high grounds to avoid percolation of rain water.

*Filling and covering the pit:* The grass to be ensiled should be cut when approaching maturity. Coarse material such as *churree* should be nicely chaffed. The pit should be filled up as soon as possible. The secret of good silage is the exclusion of air from the silo. The pits are filled well above the top, the materials are then pressed in, and immediately covered. After the material has settled, the sides and top of the pit should be plastered with mud to protect the silage against percolation of rain water. The pits should be constantly inspected, and any crack appearing in the mound, should be instantly repaired.

Silos can be opened at any time after a period of three months from its filling. When proper attention has been given to filling and covering of the pit, silage will remain in good condition for a number of years.

### *Varieties of silage produced*

The variety of silage produced is dependent upon the atmospheric temperature, its moisture content and the time taken to fill the pit. Edible silages are classified as described below into three simple types, each of which has very distinctive characteristics and can be readily recognized.

*Well made* (Green fruity)

Result of ensiling the crops in medium stage of maturity :

Colour : Green or olive green
Smell : Very pleasant, fruity or vinegary
Condition : Moderately moist ; dry matter 20 to 25 per cent; juice can be squeezed out fairly easily
Taste of juice : Tart or acid to the palate ; $p$H. 3·9 to 4·5
Value as fodder : Most nourishing and highly palatable

*Sweet* (Over-heated)

Result of ensiling a fairly mature dry crop :

Colour : Brown (dark or light)
Smell : Acrid though pleasant
Condition : Rather dry-dry matter about 30 per cent ; juice can with difficulty be squeezed out by hand.
Taste of juice : Tart or acidic ; $p$H well below 4.
Value as fodder : Readily eaten by stock but possesses low feeding value due largely to depression in the digestibility of protein.

*Sour* (Butyric)

Commonly the result of ensiling an immature crop :

Colour : Olive brown
Smell : Pungent ; unpleasant

Condition : Wet, dry matter 15 to 20 per cent ; juice can very easily be squeezed out.

Taste of juice : Not distinctly tart to the palate, and inclined to be sweetish ; *p*H approximately 4·8 to 5·4.

Value as fodder : Heavy, repulsive ; animals are made to eat with some initial difficulty ; nutritive value is not very satisfactory.

It is remarkable that there should still be much scepticism in India regarding the value of silage. The experience of the Government farms, which have made a practice of it for the past several years, clearly indicates that, when properly carried out, silage constitutes a very valuable reserve fodder. In spite of the wide propaganda of the agricultural department in various provinces, farmers remain unenthusiastic about this practice. Far greater and widespread demonstration of the preparation of silage and of the results of silage feeding would appear to be necessary. Only when farmers have seen for themselves the value of this method they will adopt this practice and make it a regular feature of Indian farming.

## CARE AT HARVESTING SAVES LOSSES

FRUIT growers and market gardeners are doing a splendid job in connection with wartime food conservation. Much loss of valuable food may be caused previous to storage or shipment by careless handling at harvest time, says W. R. Phillips, Division of Horticulture, Central Experimental Farm, Ottawa.

While great care may be taken with the marketing and storage of potatoes it is alarming to see the tubers intended for table stock which have to be discarded during the season. Close examination of these discards show that most are bruised, cut or rotted. These injuries could be avoided by careful handling. If a potato is dropped unnecessarily the skin is often broken and the tissue bruised, making excellent material for rots to develop. These rots, after getting a start, affect other potatoes, causing much loss of valuable food.

Similarly, other root crops, also cabbage, cauliflower, celery and other stored vegetables, should be handled with care. All are actually living material composed of many minute cells. Rough handling may result in breaking many of these cells, causing an area of dead tissue and bringing about food losses.

The need for careful handling of fruits is even more necessary and for that reason greater care is usually exercised. In spite of this, considerable loss takes place every year as a result of careless handling at harvest. Bruises inflicted at picking, on the wagon to the packing house, on the grader and in packing all lead to food losses.

No set rule can be laid down to correct these problems. It is just a matter of using common sense. Padding in picking baskets for tender fruits, on grading tables and orchard boxes helps. Using the proper type of digging equipment prevents loss in root crops. Proper distribution of the farm help has been known to prevent losses. When a man fails to realize the importance of careful handling he should be put on another job where he will do less damage.—*Department of Agriculture, Canada.*

# RURALIZATION OF INDUSTRY IN INDIA

By C. H. Parr

*Imperial Agricultural Research Institute, New Delhi*

At a time when much attention is being devoted to the formulation of plans for the future development of agriculture and industry, it may be profitable to give some consideration to the general question of relationship between rural and urban India. Are large cities really necessary under modern conditions in India ? Can not Industry and Agriculture be combined into a coordinated system under which the urban and the rural populations may cooperate to bring about a great agro-industrial community of interests ? An opportune moment now appears to present itself when the pros and cons of such a system may be usefully examined, the debits and credits brought into account and a balance struck. The problem of post-war development in India must be linked with the general problem of the long-term development of a country in process of modernization, and these problems necessarily differ from similar problems in other countries by virtue of the disproportionate character of urban and rural population of India when compared with other countries. Consideration of these problems must be governed by this important fact.

## *Industrial dispersion*

It has been a long-standing complaint on the part of agriculture that rural India has paid the piper but urban India has called the tune—that while land has shouldered the major burden of taxation, the towns have received the major benefits in education, medical relief, sanitation, housing, etc. The particular conditions resulting from concentration of a large population in a small area create a demand for amenities—necessities under the conditions created—which are not considered as essential in the wide spaces of the countryside, under present conditions. Industrial efficiency requires a higher standard of education which brings in its train an increased appreciation of communal amenities. A town population is thus created, and is increased by migration from the countryside—attracting at least some portion of the rural community which is most efficient in agriculture. If the special requirements of urban communities were all paid for out of the proceeds of their own labour and industry, rural India would not complain. But they are not, and the rural community wonders how long this condition will last, how it will end, and whether it is at all necessary. From the rural point of view, it may be argued that with modern means of communication, industry would stand to gain much and lose little from a planned distribution of its activities throughout the countryside, and that the considerations which in the past have led to centralization have now lost the overriding importance of the earlier days of Indian industrialization. War conditions have forced several countries to consider the advantages of industrial dispersion. It may be well to examine this principle in order to see whether some economic advantages have accrued which would justify its application to India after the war with suitable modifications. It cannot be denied that the problem of feeding India during the war would have been much less difficult had the cities been smaller and the industries spread out over the food-producing areas.

## *Intensification of agriculture*

Of India's total population, about 90 per cent are rural and virtually dependent on agriculture and its ancillary occupations. Yet, agriculture, owing to the seasonal nature of its major operations, cannot give employment to its own farm labour for more than a third of the year. Even the tenant cultivator himself is more or less idle for about half the year, though overworked during the active seasons of sowing and harvesting. The potential manpower in India is thus less than half utilized, and still less is the case with the potential woman-power. Similarly, utilization of the rural bullock power is only fractional, resulting in a lower standard of living for the cattle as for their owners and the men who work them. It is surely possible that industry and agriculture should join forces and plan a fuller use of all this wasted potential. Is it really necessary that industry should continue to create its own town population, with special problems and demands for special amenities, leaving the rural population which pays in no small measure, for these amenities, under-employed,

half-productive, and therefore half-fed and half-nourished without the ability to play its proper part as a consumer of the very articles which the city is anxious to produce and sell ?

There is no doubt that much intensification of agriculture is possible, but a degree of intensification which would be capable of producing opportunities for full-time employment and corresponding reward for the rural population is not easy to envisage. Prices of agricultural produce will not for long remain at the present high levels, nor will the present enhanced purchasing power of the rural communities, brought about by war conditions, continue after the war when prices fall. Increased crop production above the present or pre-war levels, under pre-war price conditions, necessarily presupposes increased consumption—that is, increased purchasing power and increased ability to absorb the resulting surplus in production. Since India's population is 90 per cent rural, mere intensification of agriculture would appear somewhat pointless without increased exports or the development of means, among the rural community, of absorbing the surplus on terms favourable to the producer, in order to avoid that dangerous condition of 'scarcity amidst plenty'.

### *Share in manufacturing processes*

Rural India can lay strong claims to a share in the manufacturing processes of the commodities it consumes, such as clothing, oils, fertilizers, farm implements and ornaments. Let production for export be concentrated at suitable centres, having transport or port facilities; let exporters be given all the facilities to meet foreign competition in the export market; let heavy industries be located near the source of their raw materials, but let the production of articles for the home market (which is largely the rural market) be distributed as rationally and systematically as possible throughout the areas which provide the said market and which can also provide the required labour. In this way will fuller opportunities for rural employment be found—a *sine qua non* for the improvement of the rural standard of living.

This rural labour would not require the high rates of reward necessary for townsmen, cost of living would be lower and food cheaper and better—supplemented as it would be by vegetables, milk, and dairy products produced locally or by the workers themselves. Nor need this rural labour be less efficient. The days are past when it was thought that industrial workers needed skill and intelligence superior to those employed in agriculture. If the villages can provide efficient modern soldiers, they can certainly produce modern industrial workers. These soldiers themselves, when they return to their villages after training which has at least brought about a good measure of mental development and ability to assimilate new ideas, would form the nucleus of the labour force required. Better facilities for education and some preparatory technical instruction would be necessary but given an equal standard of instruction, there is not much difference in the general level of intelligence and ability required for industrial competence, military prowess or for crop production.

It may be argued that rural industry could not afford to allow its plant and management to remain idle for a third of the year, while agricultural labour is at work in the fields. Some adjustment here is admittedly necessary but there can be no question whether the claims of management and plant should be permitted to take precedence over those of human labour now suffering from a lack of opportunity to attain even a modest standard of living. Let the plant have its holidays for overhaul and repair, and let the management take to the countryside, where they will find scope for their organizing abilities in the development of Government planned cooperative activities and rural welfare work by which rural industry will itself, in the long run, be indirectly but very definitely benefitted. When industry is producing for a localized home market, losses occasioned by periodic suspension of production and provision for storage can be adjusted in selling prices, while maintaining an economic balance due to increased purchasing power of labour and the reduction in the cost of distribution. Furthermore, prices can be protected by tariffs as in the case of sugar.

### *Mechanized agriculture*

Increasing support is now being lent to the view that there is room for mechanization in Indian agriculture. As already pointed out, field operations are largely seasonal and work is crammed into rush periods, one of which unfortunately coincides with the malaria season. Thus agricultural operations are not all carried on with the fullest possible efficiency and there is always some wastage of land and seed through faulty cultivation or untimely sowings. By speeding up these operations, mechanization can come to the aid of agriculture and go far to eliminate this waste. But the manufacture

of agricultural equipment need not become the concern solely of an urban industry. The manufacture of many component parts may be distributed over the countryside and the final assemblage carried out at suitably located works which accumulate stocks of component parts to cover the seasonal variations in the rate of manufacture but which are themselves operated continuously. The development of 'machine mindedness' in the cultivator is a necessary preliminary to effective mechanization. Let the cultivator be given an opportunity to take a hand in the actual making of the machines and improved farm equipment, and he will, the sooner, be in a position not only to use these efficiently but to mould and improve them to meet his particular conditions and needs. The present war is a highly mechanized affair and a considerable number of men from rural areas have received intensive training in the mechanical arts. Many of these men will have acquired sufficient skill to be turned to good account in the post-war development of rural industry.

The industrialist may see considerable loss of efficiency in a dispersal of industry; associated increases in cost of supervision, transport, buildings and power supply will at once occur to his mind. The existence and significance of these important factors are fully appreciated, but they represent problems which are by no means incapable of solution and would seem to be amply justified by virtue of the far more important gains to follow—such as healthier conditions for labour, stability of employment throughout the year, the smoothing out of the effects on labour of slumps and booms, the reduced contributions required against unemployment insurance and the expanding market for industry's products through an improvement of the purchasing power of the relatively enormous rural population.

### *Power supply*

In solving the problems which these proposals present, certain modern appliances may be turned to good account—for example, the use, for purposes of management and supervision, of low-flying aircraft requiring small landing space, such as have already been employed with great success in the evacuation of the wounded in jungle warfare. Sufficient planes to inaugurate the scheme, and more than sufficient personnel to operate them, already exist. The problem of power supply need not long await the development of widespread electrical distribution systems. For years to come the labour force available will be relatively large in proportion to the rural production of manufactured articles, and India has already shown what a high standard of manufacture may be obtained from hand driven machines such as lathes, shaping machines, forges, etc.

If centralization of industry is continued in the future as in the past, there would appear to be little hope of India acquiring a surplus of funds, sufficient to provide the much-needed public services for the rural population, such as education and medical relief, which services are basic and fundamental in any scheme of social improvement. As a corollary, unless those employed in industry are brought nearer to the land and its agricultural production, there appears equally little chance of providing for nutritional food standards, as a proper supply of milk and dairy products, perishable fruits and vegetables—'protective' foods that are so necessary for the maintenance of health under Indian conditions. Furthermore, an increased degree of soil fertility and a high level of crop production would result from the return to the land of public refuse and waste products, the disposal of which in large cities is a matter of considerable expense and difficulty.

Land statistics suggest that there are about 100 million acres of culturable waste (i.e. an area equal to one-third of the total sown area) awaiting development and occupation; in some of these broad acres, suitable sites for industrial development may be easily found.

### *Elimination of waste*

To a mere agriculturist, there appears to be little possibility of improving the lot of the cultivator and the agricultural labourer so long as we preserve the existing unequal competition between the urban and the rural populations for that surplus of revenue which is used in the development of social services, and so long as practically all opportunities for increased empolyment are created only in the towns and cities. The economic and social problems of the growing rural population are big enough. Catch phrases such as 'bettering the standard of living', 'increase in purchasing power', etc., suggest no remedy; they merely re-state the problem. If there is wastage involved in the present system, and if that is eliminated improvements will follow. There is too much wastage in the whole system of Indian agriculture. There is wastage of labour, of health, of land, and of water, and many more. 'Waste' has a very

real meaning and an organization which will seek it out, examine and analyse its causes, and suggest remedies in the agricultural, industrial and social spheres, will bring about results which cannot but lead to a 'better standard of living' and 'an increased purchasing power'.

### *A rare opportunity*

The present high prices of agricultural produce have but temporarily increased the purchasing power of the rural population, which is in a position to absorb more of the products of industry than before. This increase in rural wealth can no doubt be made to form the basis of a substantial rural market on which rural industries can be established. But this potential market and this increased purchasing power will be quickly dissipated, when agricultural prices begin to fall, unless maintained by the introduction, in the rural areas, of other means of earning and employment over and above those which are supplied by agriculture alone. The opportunity offered by this temporary increase in rural wealth should not be lost ; it constitutes a 'springboard' for rural industrialization. In some countries, it has taken revolutions to bring about such a change. In India today, it stands as a legacy arising out of the present war, and is available for sound investment. Centralization of industry stands today in need of critical examination to see whether it has not, to some extent, outlived its usefulness under modern conditions, or under conditions as will arise in the post-war world.

## SCIENCE IS BASIS IN U.K. AGRICULTURE

HOW the members of the teaching, research, advisory agricultural staffs, and other representatives of technical agriculture in Britain take a full and active part in the general organization, and running of wartime agriculture of the country was explained to the Canadian Society of Technical Agriculturists at their recent annual convention by Professor Robert Rae, Agricultural Attaché to the British Embassy, Washington, D.C.

In the agricultural set-up in Britain, the Ministry of Agriculture is supreme and is primarily concerned with all production problems for the preparation of programs and goals ; the allocation of the farmers' raw materials, feeding stuffs, manures, machinery, and the control of all technical services, together with the methods by which they can all be best utilized in the national interest.

The Ministry of Agriculture is assisted by regional liaison officers and by special advisory officers drawn from the ranks of technical agriculturists, said Prof. Rae. There are three main bodies also to help the ministry :

(1) War Agricultural Executive Committees, the members of which include representatives of land owners, farmers, and farm workers. They are unpaid and function on a democratic basis, their powers including that of being able to compel any farmer to improve his farm or surrender it, if he falls below specific standards ;

(2) District Committees, appointed by the Executive Committees, to represent them in areas within the country ;

(3) Parish Representatives who maintain direct contact with individual farmers. Meanwhile, the Ministry consults regularly with the National Farmers' Union, the Workers' Union, and the Central Land Owners' Association.

Agricultural Research is to a large extent financed by the State, and in co-ordination of its work, three Government Departments are mainly concerned : the Ministry of Agriculture, the Department of Agriculture for Scotland, and the Agricultural Research Committee. The function of the Research Committee is to promote and co-ordinate scientific research in agricultural and allied problems. An Agricultural Machinery Board has centralized facilities for testing and standardizing agricultural machines designing new types to meet special needs, and provide an adequate educational and advisory service, including demonstrations.

The Special Advisory officers, most of whom are employed by the County Committees are playing their full part in the program of increased and more efficient feed production. Among them are soil specialists and entomologists upon whom the Ministry relies for up-to-date information.—*Department of Agriculture, Canada.*

# SOME COMMON BREEDS OF GOATS IN INDIA-II

By S. K. Sen, M.R.C.V.S.

*Assistant Animal Husbandry Commissioner with the Government of India*

A PREVIOUS article[1] by R. L. Kaura under the above title described seven important breeds of Indian goats and also dealt with the total goat population in India, their economic importance and the value of goats for milk. In the present article, which is the second of the series, eight more breeds are described and in a later article some more breeds will be dealt with.

## Osmanabad

*Habitat and distribution :* This breed is found in the Osmanabad district of the Nizam's Dominions, where the best types occur in the hilly tracts having a fairly dry and salubrious climate, at altitudes ranging from 1,900 to 2,000 ft. above sea-level. The goats thrive on the foliage and pods of *babul* trees, found in groves in the district, as well as on the good grazing available.

*General description :* The goats are divided into long- and short-haired types, the latter possessing fairly long hair on the thigh and hind-quarters. They are large in size, the weight of fully-grown animals being as much as 85 lb. The height varies between 30 in. and 35 in., and the horns measure between 5 in. and 6 in. in length. The common colour is black, although a mixture of white and black or red is often noticeable.

*Milk yield :* The milk yield varies from 2 to 5 lb. a day, but in exceptional cases as much as 6 lb. at the peak of lactation has been recorded.

*Other qualities :* The breed is considered a dual purpose one, i.e. for meat as well as milk production, having marked potentialities for the latter. Under favourable conditions of feeding and management, the female drops kids regularly twice a year and twinning is quite common. These animals are exported in large numbers to Barsi, a market in the Sholapur district of the Bombay province.

## Lerri

*Habitat and distribution :* This breed, known for its peculiar long ears, is found throughout central and southern Sind, in both rural and urban areas. Their natural home is the jungle. They subsist on small bushes like *salsola, albani, indigofera* and leaves of trees like *babul, ber, peepul, etc.*

*General description :* There are two types of Lerri goats, one with long and broad ears, the other with wide but shorter ears. The first type is not greatly valued by the breeders as its long ears are susceptible to frequent injury from thorny shrubs. The second type with smaller ears is also called Labi. The predominating colour is black, but black with white spots is also seen. The Lerri breed is of medium size with spiral horns. The ears in the long-eared type measure from 21 to 24 in. in length and 5 to 6 in. in width, whereas in the smaller-eared type they are between 10 and 12 in. in length. The skin is generally covered with hair about 3 to 4 in. long, and shearing is done in April or the beginning of May. The hair is generally used for making ropes and carpets. The live-weight of an adult goat varies from 55 to 60 lb. in the case of the female, and 65 to 70 lb. in the male. The animal is economical both for milk and flesh, but as a rule it is reared for slaughter.

*Milk yield :* The Lerri breed is reputed for its milk production, and for this purpose the females are fed on concentrates. The milk yield is about 4 lb. per day on an average.

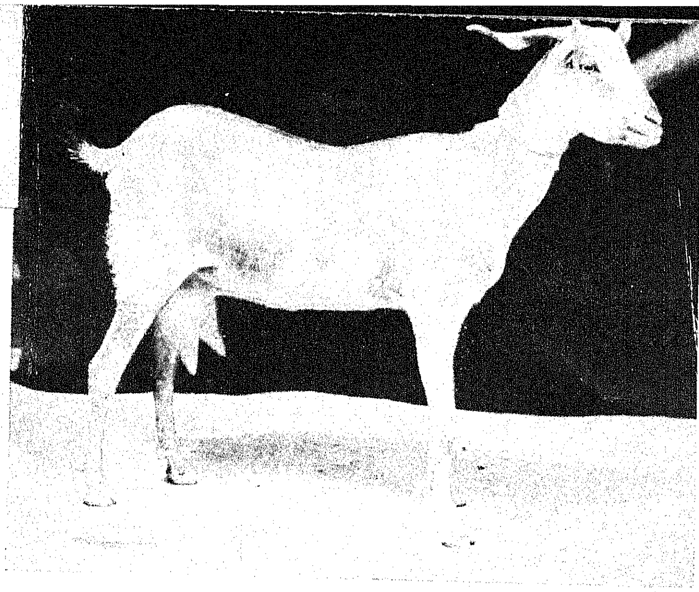
## Thori

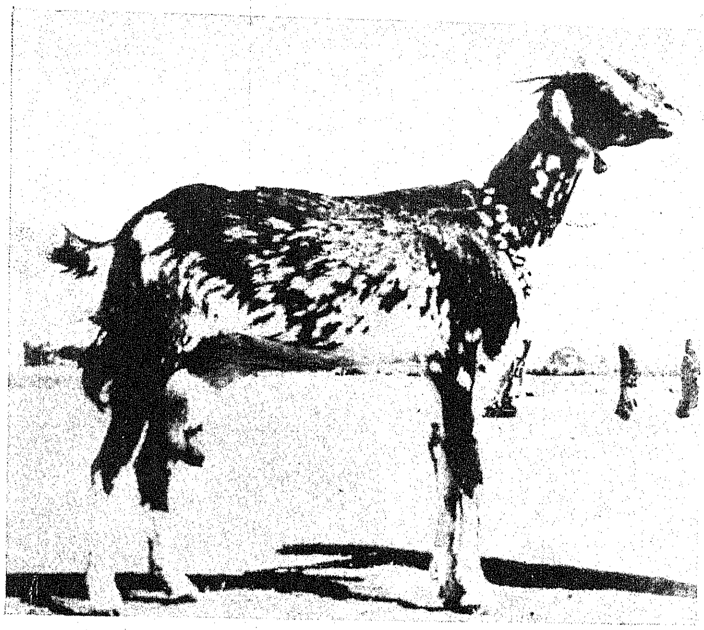
This is a hornless breed and is locally known as Thori Bari, as it resembles the Bari breed in all other respects except that horns are absent.

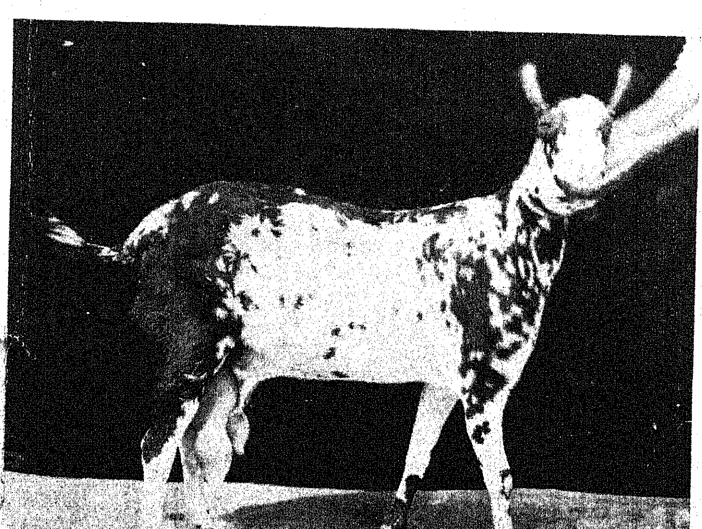
*Habitat and distribution :* The goats of this breed are commonly found along the right bank of the Indus and in the large towns in the Upper Sind frontier districts.

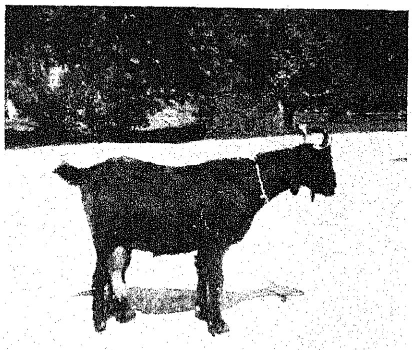
*General description :* The predominating colour is red, but a mixture of other colours with white or black spots is not uncommon. The head is small, with a slight furrow at the centre, and the face is of medium length, with bright eyes. The ears are 4 to 5 in. in length, and give the appearance of a longitudinally folded leaf. The neck is thin and long.

[1] INDIAN FARMING, Vol IV, No 11., p. 549.



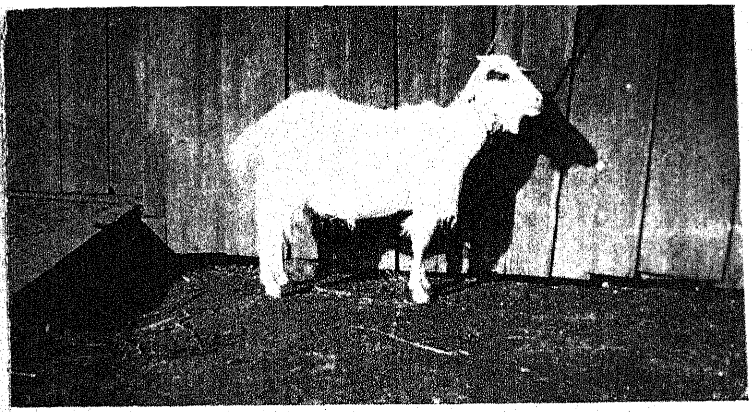




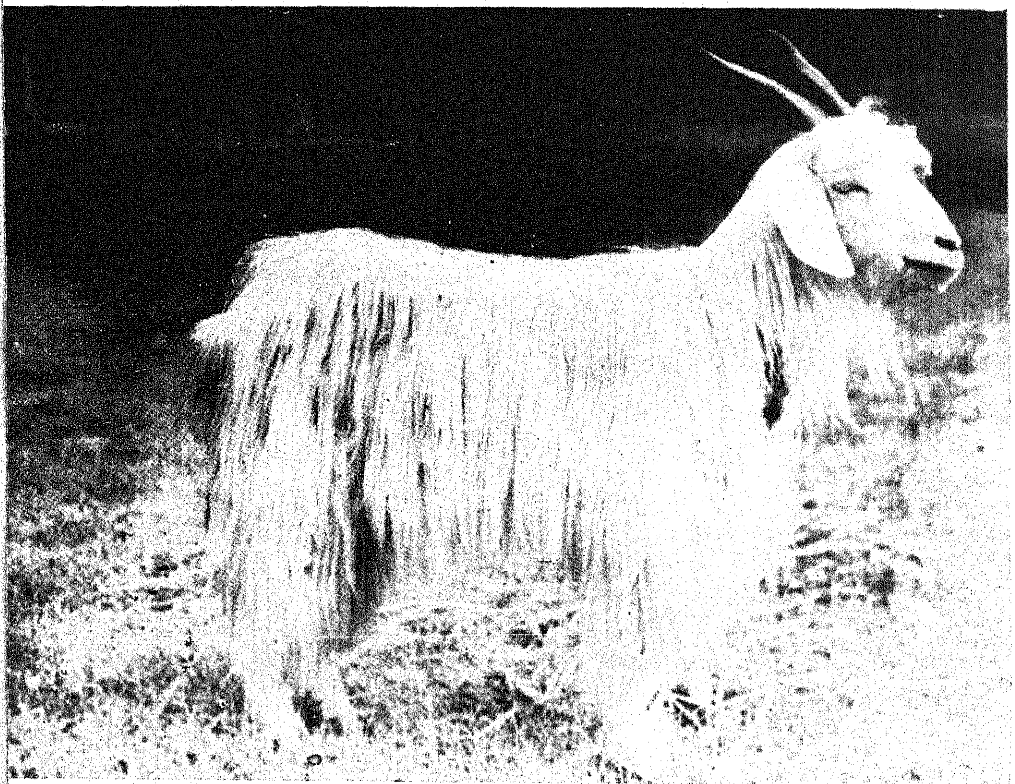


Dera Din Panah

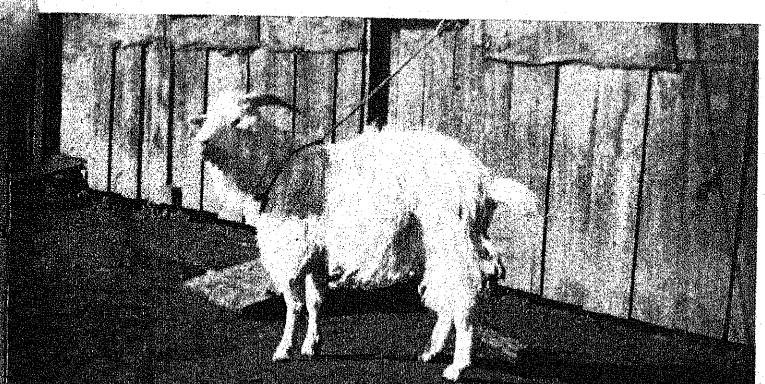
Bari (top left), Osmanabad female goat (centre), male (top right), Thori (bottom left).



Khasi hill goat (female)



Gaddi goat



Khasi hill goat (male)

*Milk yield :* The udder is full and well-developed. The teats are of medium size, varying from 4 to 6 in. in length and are placed well apart. The average yield of good animals is about 3 to 4 lb. per day. The milk is supposed to be very rich in butter fat.

*Other qualities :* The skin is soft and is covered with a thick growth of short, shiny hair. As the hair is short, no shearing is done. The mutton is of good quality, and the average yield is from 28 to 30 lb. in the case of the female and 40 to 45 lb. in the case of the male.

### Bari

*Habitat and distribution :* This breed is well distributed throughout the province of Sind. They live in the plains where small shrubs and crop stubbles constitute their principal food. In larger towns this breed is preferred because of its small size, good appearance and fairly good milking capacity.

*General description :* The colour is commonly white, and sometimes white and red or black are seen. Bari goats possess a round barrel, clean-cut legs and are active and agile. The hair is short, smooth and shiny. The ears are short, and the animal resembles the deer in many respects. The average live-weight of the female is 45 to 50 lb. and of the male 55 to 60 lb.

*Milk yield :* The udder is well developed, considering the size of the animal. The teats are 5 to 6 in. long and well set. The breed is reported to be a good milker and is considered to be most economical in large towns. The average milk yield is from 3 to 3½ lb. per day.

*Other qualities :* The breed is believed to possess high fertility and generally drops two or three kids at a time. The meat is of good quality, the yield being 25 to 30 lb. per animal.

### Dera Din Panah

*Habitat and distribution :* The original home of this breed is said to be Dera Ghazi Khan. These animals are found in Dera Din Panah, Kot Adu, Ashanpur and Leiah.

*General description :* The colour is generally black, but red and light-red are also noticed. They are tall, have the outline of well-shaped dairy cows, and carry long, glossy hair about 5 in. long. The hair is clipped twice a year. The horns are spiral, turning backwards, upwards and slightly outwards. The ears are long and pendulous. The males have a prominent roman nose. Both males and females are bearded.

*Milk yield :* The females are good milkers and carry large udders with long teats which nearly touch the ground. The milk yield is between 5 to 7 lb. per day and, with very good feeding, the yield may be brought up to 9 lb. The lactation period during the whole year is about 7½ to 8 months.

*Other qualities :* The goats are heavy and the average yield of meat is between 54 and 60 lb.

### Cheghu

*Habitat and distribution :* The home of this breed of goats is in the high mountain ranges of Spiti, Yaksar, Kashmir and Tibet.

*General description :* They are smaller than the Gaddi goats in size, but the weight of male and female is 70 to 80 lb. and 30 to 40 lb. respectively. The colour is usually white ; but greyish red and mixed colours can also be seen. The face and muzzle are tapering. Horns bend backward and outward. They possess long hair below which is a second coat of fine hair or *pashmina*. *Pashmina* is graded into different classes according to fineness and sold in Kulu and markets of the Kangra district. Fine *chaddars* and mufflers are manufactured from the fine hair. The Cheghu, if brought to lower altitudes, loses its second coat and cannot stand the heat very well. As the high hills are devoid of scrub forests, the animals subsist on shrubs and leaves, but chiefly on grass, locally known as *neru*. In addition to use as slaughter animals, they are worked as pack-animals to carry salt and similar small loads.

*Milk yields :* The milk yield is about 8 to 12 oz. per day.

### Gaddi

*Habitat and distribution :* The home of the Gaddi breed is in the Gadderan tract inhabited by the *Gaddis*, a tribe of professional sheep and goat raisers. This tract lies in the Himalayan ranges in the neighbourhood of Kangra proper and the Chamba State. They are also found in the Simla district and Sirmoor State. Flocks of goats, sometimes comprising as many as three to five hundred, are owned by the *Gaddis*, who are specially adept in the art of large-scale goat-rearing. Goats are brought down to the lower ranges for wintering and are moved up by the beginning of April on to the southern slopes of snowy ranges. In June they cross over the hill ranges to their summer quarters in Chamba or Lahoul. In a similar manner, the descent after the summer is completed in definite stages according to season. The goats of this breed

thrive on the leaves of trees and bushes they encounter at different altitudes, and during winter the lower forest areas are extensively grazed upon.

*General description :* The animals are well-built and sturdy, can climb hills of common height and can stand long journeys. The colour is mainly white, but grey and red may be occasionally observed. The herd possesses a tapering muzzle, prominently set and alert eyes, well-cut or slightly roman nose and drooping and pointed ears about 5 in. long. The horns are pointed at the apex, bending upwards and backwards. The skin is tough and is covered with coarse, long hair measuring between 7 and 10 in. One clip weighs 1½ to 2 lb. The hair is not clipped, but collected from dead animals and made into ropes, snow-boots and coarse *saila* or rug. The average weight of male and female are 70 and 40 lb. respectively.

*Milk yield :* The udder of the female is small and well-set, with short, pointed teats. The average milk yield is 12 to 18 oz. per day.

*Other qualities :* Although the meat is coarse and devoid of fat, this breed is widely used for sacrificial purposes. The she-goats are used to provide milk for lambs which do not obtain sufficient nourishment from ewes at their first lambing.

### Assam hill goats

*Habitat and distribution :* The animals of this breed are found in the villages of Khasi, Naga and Lushai hills. They are reared by the Abor and other hill tribes.

*General description :* All true hill goats are bearded and long-haired and the typical sheen of long coat hair is noticeable. They are generally pure white in colour but often silver to dark grey shades are seen. The animals are short-legged, and long-bodied. The ears are short—about 6 in. The horns turn from the head backwards and do not begin to curl until the age is advancing in the male, while in the female they seldom increase to more than 4 in. An adult male weighs about 60 lb. and the female up to 50 lb. The majority of the animals kid twice a year and twins are common.

*Milk yield :* These animals are not generally milked.

*Other qualities :* The goats are kept for slaughter. The meat is of good quality and is well known for its flavour.

# UTILIZATION OF THE WASTE PRODUCTS OF TOBACCO

By T. Narayana Rao

*Superintendent, Tobacco Research Sub-station, Guntur*

In the tobacco plant the leaf is the only part commercially important and the other parts are usually wasted. The seeds yield an edible, semi-drying oil, which is useful as an illuminant. The cake is a nutritious cattle feed and can be profitably used as a manure. Tobacco is a heavy potash feeder and all plant parts are a rich source of potash and hence the stalks and the midribs of leaves are very useful as fertilizers. Nicotine sulphate which is a powerful insecticide can be manufactured from the waste products of tobacco. Tobacco thus furnishes refuse material which can be exploited for valuable products.

### *Tobacco seed*

Tobacco varieties, other than the cigarette varieties, are 'topped', i.e. the growing shoot is cut at the time of flowering, but the cigarette varieties are usually allowed to flower and bear fruits. Within the last few years, the area under cigarette tobacco has increased enormously and in the Madras province alone is estimated to be about 120,000 acres, concentrated chiefly in the Guntur district. The crop over this large area is allowed to run to seed which is practically wasted. Tobacco seed is very small (an oz. contains 3 lakhs of seeds) and a very small fraction of the total production is enough for seed purposes.

Tobacco seed thus offers a by-product which can be put to good use. Though tobacco leaves contain the alkaloid nicotine, which is a poison, the seeds are entirely free. Numerous tests conducted all over the world have proved this.

### *Tobacco oil*

The seeds contain about 25 per cent of oil. The oil is edible and can be used for culinary purposes. In certain European countries, e.g. Bulgaria, it has been in use for several years. It resembles *til* oil in colour and flavour. The oil is also claimed to be a semi-drying oil, drying when applied to wood or glass in about 72 hours. When treated with lead oxide the time is reduced to about 24 hours. The iodine value (hot drawn) is 138·7.

The oil is produced comparatively cheap. Hitherto in our experiments the ordinary country oil mills, such as those used for *til*, have been used. Recently however one of the local groundnut factories has taken this up and has started extracting oil from tobacco seed selling the oil at Rs. 6-6 per 25 lb. and the cake at Rs. 22 per candy of 500 lb. As these mills are not perfectly suited for the small tobacco seed the recovery of oil is only about 20 per cent.

The grower can collect the seed and get it crushed. The collection charges of a bag of seed (about 150 lb.) from an acre would be a rupee and expenses of crushing Rs. 6. The returns would be as follows :

| | | | | |
|---|---|---|---|---|
| Oil (30 lb.) | Rs. | 7 | 7 | 0 |
| Cake (120 lb.) | | 4 | 3 | 0 |
| | | 11 | 10 | 0 |
| Expenditure | | 7 | 0 | 0 |
| Profit | | 4 | 10 | 0 |

Thus, in terms of value there is a gain of about Rs. 5 per acre.

The oil also appears to be capable of use as an illuminant. It can be used in place of castor oil for the old fashioned country (mud pan) lights burning with hand-made wicks. It burns steadily, giving a mild light and with thin wicks the flame is smokeless. The consumption of oil is low. An ounce of oil burns for six hours. The *Madras War Review* for March 1943 has reported the following results of experiments with different vegetable oils for illumination purposes. The trials were made with 'Rama Deepa'.

| Kind of oil | Duration of light for 3 oz. oil |
|---|---|
| Tobacco seed oil .. .. | 21 Hours. |
| Groundnut oil .. .. | 21 „ |
| *Pungam* oil .. .. | 20 „ |
| *Ippah* oil .. .. | 20 „ |
| Margosa oil .. .. | 20 „ |
| Mustard oil mixed with 25 % groundnut oil .. .. | 25 „ |

### *Tobacco cake*

The seed being free from nicotine, the cake can be fed to cattle or used as manure. In

fact, sheep, goats and cattle roaming in the fields eat the fruits with relish. The nitrogen and protein values as shown in the analysis by the Imperial Agricultural Chemist, Imperial Agricultural Research Institute, New Delhi, are as follows:

| | Moisture | Nitrogen per cent | Protein per cent |
|---|---|---|---|
| | | on oven-dry sample | |
| Tobacco cake (hot drawn) | 5·22 | 5·73 | 35·81 |

In analysis it compares very favourably with *til* cake.

The cake contains about 5 per cent nitrogen, 1·15 per cent potash and 1·6 per cent phosphoric acid. In its manurial value it resembles castor cake. If the seed is converted to ash the nitrogen is lost but it is very rich in potash and phosphoric acid.

Analysis of tobacco seed ash are as follows :

| Total nitrogen N per cent | Phosphoric acid $P_2O_5$ per cent | Potash $K_2O$ per cent |
|---|---|---|
| 0·16 | 7·15 | 5·47 |

As noted above, there is an area of about 120,000 acres under the cigarette varieties which are allowed to produce seed. At a modest estimate of 150 lb. of seed per acre, over 8,000 tons of seed will be available. Almost all this quantity which is now going waste is capable of giving 6,000 tons of cake and 2,000 tons of oil. The cake alone will be worth about Rs. 300,000 and should be capable of relieving to some extent the scarcity of manures, at least in the districts around the chief tobacco-producing centres, especially at a time when transport is so difficult. The fact that cigarette tobacco cultivation is concentrated in a few districts must greatly help the starting of an industry.

### Tobacco stalks and midribs

*Tabacoo stalks :* In the case of tobacco, after the leaves are harvested the stalks are pulled out and used as fuel. Though the ash may ultimately find its way to the manure pit, much of it is easily lost and, in any case, it is desirable that tobacco waste, in view of its rich manurial value, should be separately conserved.

At the Tobacco Research Sub-station, Guntur, the possibility of utilizing the stalks was investigated. The stalk is hard and woody and does not compost easily. But it can be used as fuel and the ash can be collected and used as fertilizer. In the form of ash its transportability is also greatly increased. At the Tobacco Station, we found it most convenient to use it for burning on the seed beds ; while it sterilizes the bed, it also enriches the bed with potash.

The composition of ash from tobacco stalks is as follows :

| Total nitrogen N per cent | Phosphoric acid $P_2O_5$ per cent | Potash $K_2O$ per cent |
|---|---|---|
| 0·10 | 0·68 | 5·58 |

An acre of tobacco yields about 500 lb. of stalks (dry). The ash has been calculated to be 8·5 per cent of the dry weight of stalks. On this basis Guntur alone is capable of producing 145 tons of potash which is equivalent to about 300 tons of potassium sulphate. With potash so scarce this is not a negligible quantity. And India with an acreage of nearly a million and a half acres of tobacco can provide a rich source of potash.

### Tobacco 'stems'

The midribs of the tobacco leaf are hardly ever used for smoking purposes. Hence in the case of tobacco used in India the midribs are available as a waste. Most of the tobacco exported to the United Kingdom is 'stemmed' before export, that is to say, the midrib is removed. This is a waste product retained in the country. In the case of *desi* tobacco also the midribs are available. At a conservative estimate, in the Guntur area alone, 8 to 10 million lb. of these 'stems' are available annually for use as manure. These are easier to compost, but the transportability is greatly increased by converting it into ash. The composition is as follows :

| | Organic N per cent |
|---|---|
| Virginia tobacco stems (midribs) | 1·50 |
| *Desi* tobacco stems (midribs) | 2·06 |

*Ash composition*

| | $P_2O_5$ per cent | $K_2O$ per cent | Cl per cent | Alkalinity per gram of substance expressed as $N/10$ acid |
|---|---|---|---|---|
| Virginia tobacco stems (midribs) ash | 1·97 | 28·81 | 16·39 | 13·97 c.c |
| *Desi* tobacco stems (midribs) ash | 1·40 | 29·75 | 21·25 | 1·89 c.c |

*Desi* tobacco is richer in nitrogen on account of the heavier manuring it receives and also because it is topped and the nutrient material is prevented from passing into the seed. The potash content is very high and thus the tobacco stems offer an exceptionally rich source of potash[1]. To allow 8 to 10 million lb. of this material to lie idle on the hands of the exporters or to be dissipated would be most undesirable, especially in these days.

The leaf itself is rich in plant food and contains about 2 per cent nitrogen and 4 per cent potash. On account of the war, and the closing of the far east market several million lb. of low-grade tobacco leaf is locked up either with the merchants or the cultivators. Considering its high manurial value, it may be desirable to convert it into manure and provide transport facilities.

The many analyses reported here show clearly the manurial value of tobacco ash and other wastes. Though no experiments have been conducted at any of the research farms, ryots in the Guntur area are realizing the value of these wastes found to be particularly suitable for manuring of paddy and other irrigated crops. Observations show that the stems are very beneficial to the crop and there is a great demand for them from the paddy cultivators. Practical experience shows that these wastes can be applied safely and with profit to irrigated crops. Tobacco midribs are being largely used for manuring tobacco seed beds.

[1] The ash of virginia tobacco 'stems' (midribs) is alkaline and so should be used with caution, and preferably in combination with acidic manures. This does not apply to *desi* tobacco stems which are far less alkaline.

Chlorides in small quantities are beneficial to tobacco, but an excess affects the burning quality. Hence, their use for tobacco should be limited, particularly flue-cured tobacco.

## *Save the ash*

Most of the tobacco produced in India is used for smoking purposes. After the tobacco is smoked it leaves behind the ash which, as we have seen above, has a high fertilizing value. If the smokers make up their minds not to throw away the ash, in a very short time a surprisingly large quantity of ash can be gathered. Hence '*save the ash*' would not be a bad slogan for all smokers and restaurateurs.

*Nicotine sulphate* : Plant parts other than seeds contain nicotine. Nicotine sulphate which is a powerful insecticide can be prepared from the waste products of tobacco. The process is very simple and cheap, and these waste products can yield their nicotine and yet be as effective manures as before.

## *Conclusion*

Tobacco thus offers a variety of waste products which can be used to produce better crops. Every cultivator should therefore be encouraged to conserve it properly. As it is a rich source of potash, crops like sugarcane, potato, plantain and tobacco are likely to benefit more than other crops. It should therefore be the endeavour of everybody to encourage the pooling of all these waste materials and to facilitate the application of the products to the crops that need them most.

# BROODING

By A. J. MACDONALD

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THE successful poultry farmer must be able to hatch and rear a high percentage of good quality chicks. The number of chicks reared depends upon factors such as quality and condition of breeding stock, good hatching results and sound management during the brooding period. Poor breeding stock will not prove profitable, for good management and feeding cannot turn badly bred birds into good producers. It must, however, be remembered that a good quality breeding stock is not sufficient by itself for success, as errors in hatching and rearing may ruin the progeny. The breeding stage is by far the most important period in the life of fowls, as young chicks are very delicate for some time after hatching and are less able than older birds to stand up to unfavourable environmental conditions.

During the early stages of growth, it is essential to keep young chicks warm and comfortable and to feed them on a well-balanced ration. The growth rate varies according to the season; chickens in the cold weather almost invariably grow quicker than those hatched during the hot months. In northern India, the best growth results are obtained from November to February. However, though the rate of growth is lower at other periods of the year, it is nevertheless possible to rear a high percentage of chickens in other seasons, provided they are housed properly. Breeders in some parts of southern India prefer rearing in the monsoon months but in these parts there is no real cold weather period. In view of great climatic differences in different parts of the country, it is impossible to lay down any hard and fast rule in regard to rearing dates, and the poultry breeder must be guided by local experience.

## *Natural brooding*

Brooding under hens is almost invariably the practice under village conditions. Provided the proper type of mother hen is used, natural rearing is very suitable for small-scale production, as artificial brooding is only economical for mass production. The *desi* hen is an ideal mother as in her the brooding instinct is very well-developed and her small size protects the chicks against injury through tramping. The sitting hen should never be disturbed during the final hatching period and if left to herself, she will sit tight on the nest until all the chickens are hatched.

A good hen can look after at least 15 to 20 chickens according to her size. As hens cannot accommodate or hatch as many eggs at a time it is good policy to set two lots of eggs on the same date and afterward amalgamate all the hatched chicks under one hen. Chickens of different ages should not be run together under one hen, for the mother does not take readily to the new set of offsprings. Amalgamation is best done at dusk some 24 hours after hatching.

In order to safeguard the health of the young chickens, the hen should be thoroughly deloused before hatching. Delousing can be done very effectively by dusting a good insecticide such as sodium fluoride around the vent and under the wings. A mixture of finely ground tobacco leaves and fine ash also gives good results against lice.

Losses in chicken rearing are often high on account of attack by predatory animals and birds. In order to protect against such losses, it is good policy to keep the hen shut up in a coop and allow the chickens out into a small separate run which is covered on the top as well as the sides. In peace time, ½ in. wire mesh made an ideal run but this, at present, is almost unobtainable at any price. A good substitute is bamboo *jaffrey*. The coop and run should be moved on to fresh ground about twice a week in order to keep the ground clean and free from disease.

## *Artificial brooding*

Artificial brooding means the rearing of chickens without a mother hen. It requires more skill, and for large-scale production, it is better and more reliable than natural rearing. One of the main advantages of artificial breeding is that it enables the operator to rear his chickens during the best rearing season; in the case of natural rearing, it is often difficult to obtain the requisite number of broody fowls. Artificial brooding also helps to eliminate diseases or

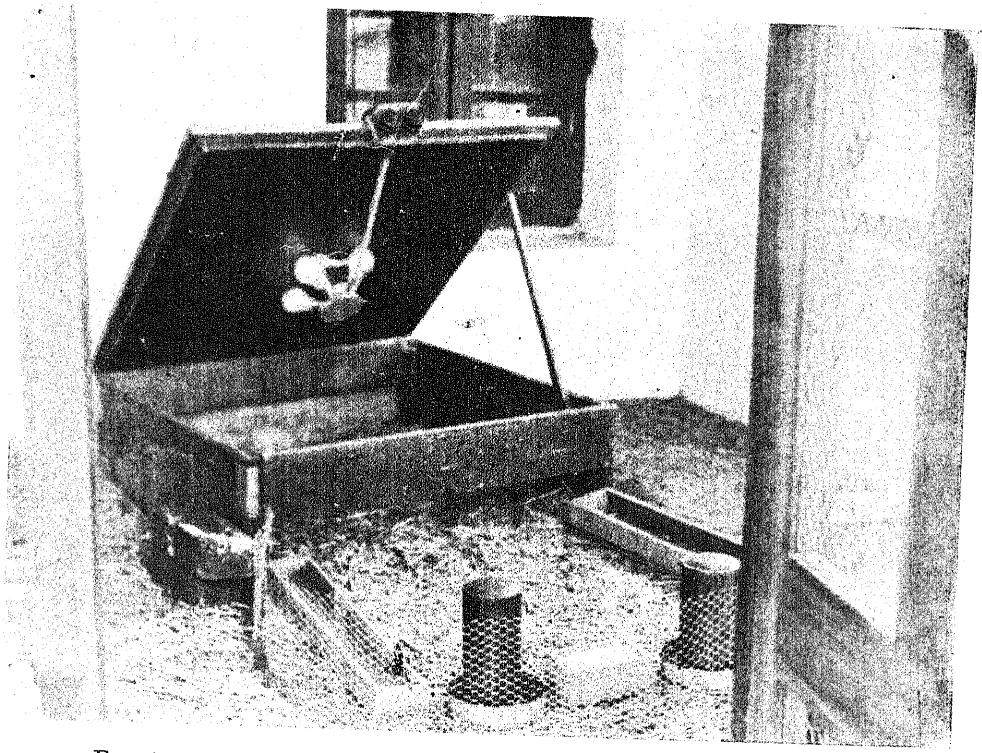

FIG. 1. About 200—size electric brooder ready for receipt of chickens.

FIG. 2. Electric brooder and chickens.

PLATE 36

parasites which are all too frequently passed on from the hen to the young chicks.

A good brooder house is very essential for success. It should be so designed as to afford adequate ventilation and give freedom from draughts and protection from high temperatures and dampness. The size of the brooder house will depend upon the number of chickens to be reared and the system of management selected. If a very large number of chickens are to be reared, it is desirable to have a number of comparatively small houses or a large house divided into a number of separate compartments. A number of small houses are more expensive than a large house though small, well-separated units insure against the spread of infectious diseases. Small units also give better growth results than large ones but they increase labour costs. On a well-run farm, units of 100 to 200 chickens give good results.

Adequate floor space in the brooder house is essential, for overcrowding results in uneven and poor growth and in high mortality. There is little authentic information available on the optimum floor space requirements. The larger the floor space the better are the results. From commercial aspects, however, it is necessary to limit floor space on account of high costs. Fairly good results are obtained with a floor area of ¾ sq. ft. per bird, i.e. 75 sq. ft. for 100 chickens.

### The brooder

In artificial rearing, it is usually necessary to provide the chickens with some form of artificial heat. The heating unit is known as the brooder or foster-mother. A good brooder is very important in rearing chickens artificially, for improper temperatures will result in high losses and poor growth results.

With a small number of chickens, it is possible to get good rearing results from fireless brooders, i.e. in cold brooding. The chickens have to be reared in comparatively small groups and the brooder is designed to conserve the heat thrown off by the chickens themselves. An ordinary *bazaar* basket, lined with soft hay on the sides, covered on the top and provided with a small hole to allow the chickens to run in and out, is quite satisfactory. A basket 15 in. in diameter will provide accommodation for about 30 chickens. During the first few days, the chickens need special attention and nursing and they should be confined near the basket to prevent them from straying into corners where they are liable to huddle and catch a chill. For the first few days they should also be inspected regularly and shut in at night. After the first week, they require no special care, for they will run into the basket whenever they feel chilled.

*Types :* For large scale production however it is usually more practical to rely on artificially-heated brooders. Such brooders may be classified as follows : lamp-brooders holding 25 to 200 chicks, electric-brooders holding upto 500 chickens, stove-brooders heated by coal or oil with a capacity to hold 200 to 1000 chicks, hot-water-pipe brooders divided up into sections for rearing large groups of chickens of different ages, and finally heated rooms and battery-brooders.

*Lamp-brooders* heated by kerosene are the most popular for small-scale production. For inside use, simple types prove satisfactory but for outdoor conditions more elaborate patterns are required in order to protect the chickens and the lamp from the elements. Good quality oil should be used and the wick and lamp should be kept thoroughly clean. The oil container should never be filled to capacity, for the heat from the lamp will expand the oil which may overflow and cause fire.

*Electric-brooders* are very convenient, but can only be used economically where cheap current is available. A reliable source of electricity is most essential for even one breakdown during a cold night might cause very heavy losses amongst young chickens. There is a tendency for manufacturers to overestimate the holding capacity of their brooders so as to increase their sales. The capacity of brooders can be estimated on their floor space ; each chick should be given not less than 7 sq. in. of floor space, i.e. not more than 20 chickens should be kept in a brooder with a floor space of 1 sq. ft.

*Temperature :* The best running temperature is that which provides the maximum comfort for the chicks. Though the recording of temperature may be a good guide to the beginner, the experienced breeder is guided entirely by the behaviour of the chicks themselves. When the temperature is too low the chickens will be restless and will crowd together towards the heat. With too high a temperature the chickens pant and try to get away from the heat. When the temperature is correct, the young chickens spread out and lie well-spaced out all over the floor space when first transferred from the incubator. For newly hatched chickens, the temperature should be around

100°F. with the thermometer suspended 2 in. above floor level just inside the outer edge of the brooder canopy. The temperature should be reduced each week by about 5°F. and the chickens should have the heat cut off entirely at the earliest possible opportunity, for keeping chickens too long in warmth tends to weaken their vitality and interferes with the growth rate.

The brooder-house temperature is also important, for the best and most vigorous chickens are reared in a cool room when there is ample heat in the brooder. In warm rooms, the feathering is poor and the growth is uneven. Once the chickens are used to running in and out of the brooder (3 to 4 days after hatching), they thrive better if given full access to the whole brooder house. Chicks being reared for stock purposes, should also be allowed outside at a fairly early date.

*Litter* : The entire floor of the brooder house should be covered with a layer of good absorbent material such as *bhoosa* or dry, clean sand. The litter serves to absorb moisture from the droppings and keeps the floor clean. The litter should be spread to a depth of 1-2 in. and should be removed as soon as it becomes damp or gets fouled with excreta from the birds.

## Feeding of chickens

Text books often state that chickens should not be fed during the first 48 hours but this theory is not supported by experimental work. It is probably better to start feeding from the very beginning, for chickens deprived of food or water peck at each other and pick up litter and droppings which may cause digestive troubles.

It is essential to supply ample hopper space. Lack of feeding space results in weaker chickens being pushed aside, uneven growth and a tendency to feather-pecking and cannibalism. Each chick should be given at least one lineal inch of feeding space and for every 100 chickens at least two hoppers, each 2 ft. in length, should be supplied. As the chicks get older, the hopper space should be increased.

An ample supply of fresh, clean water is very essential. The drinking vessels should be designed to prevent soiling of the water which should be replaced at least twice daily. The water containers should never be left empty for any length of time.

For young chickens it is essential to feed rations rich in protein, for the rate of growth is relatively faster during the first eight weeks than at later stages. As cereals are all deficient in protein, it is necessary to balance up a cereal ration with protein-rich supplements. Though certain vegetable proteins are helpful in balancing up the protein deficiencies of cereals, better results are usually obtained from animal proteins.

Milk is an ideal protein supplement especially for young growing chickens. Separated milk and buttermilk give as good results as that given by whole milk. From 0 to 8 weeks, good results can be obtained with either separated milk or buttermilk as the sole protein-rich supplements. The milk products should be given *ad libitum* in drinking vessels and no water should be fed. In the absence of milk, good results can be obtained from meat offal. The meat offal should be cooked for one hour prior to use and then minced fine, mixed with the mash and fed in a crumbly state. From 0 to 8 weeks, one half pound of meat offal should be fed for every pound of mash plus grain.

Unless the chickens are allowed out of door on to green grass, it is essential to safeguard against vitamin A deficiency by feeding once daily liberal doses of succulent green food. Calcium, in the form of broken limestone or shell grit, should also be fed in small hoppers from the second day forward.

Chickens can usually dispense with artificial heat from 3 to 4 weeks or even earlier at certain periods of the year but in order to prevent losses from wild birds, it is wise to keep them in the brooder house and protected runs until the birds are about 8 weeks old. At eight weeks the birds should be sexed and the males and females transferred to separate pens. Separating the males at an early age gives a better chance to the weaker pullets.

The skill of the poultryman can be judged by the weight of the chickens and their evenness at the time of sexing and the percentage reared. The rearing losses vary from group to group and season to season but on an average, the good producer should rear a minimum of 85 per cent of all chickens hatched. An average loss of under 10 per cent from 0 to 8 weeks can be considered very satisfactory.

# ERI SILK INDUSTRY IN ASSAM

By H. K. Nandi, M.Sc., Ph.D.
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ERI is a kind of silk obtained from cocoons of the caterpillars of *Attacus ricini* and so known because the cocoons feed on the leaves of the castor plant (*Ricinus communis*) known as *era* in Assam. *Era* is an indigenous plant and in certain tracts grows abundantly in a self-sown condition in homestead land. Hence the rearing of *eri* is much easier than that of any other silk worm. There are usually six broods of *eri* in a year but the periods between September and November and between February and March are most suitable for its rearing as they are neither very cold nor very wet.

## A popular cottage industry

The rearing of *eri* is a very popular cottage industry among the masses of the Assam Valley and it is most widely practised in the Mikir Hills. Although no records of statistics are available, rearing of *eri* may safely be said to be connected with the earliest history of Assam.

*Eri* silk has a very hard texture and as such it is more durable than any other type of silk or cotton yarn. The fibre may be spun very fine or rough and there are some very expert spinners who can spin very fine quality yarn without a single clot in it. Any kind of cloth may be woven out of the yarns. Weaving depends upon the size of the fibre and the reeds have to be selected accordingly, but 40s count reed is conveniently used. This can be done in handlooms or fly shuttles.

*Eri* cloth is a very popular and favourite cloth in Assam. There are instances of its being used for making mosquito curtains also in certain places. It has the further advantage of serving the purpose of warm clothing in winter and rough or decent wear in summer.

## Peculiarities of eri silk

*Eri* silk differs from others in the sense that it cannot be reeled as each layer of the cocoon gives only about 8 to 10 yards of yarn. This is a peculiarity in the formation of the cocoon, one end of which is left open for the emergence of the moth. The yarn is deposited layer upon layer. In the usual course, spinning of *eri* silk, therefore, does not entail killing of too many pupae and as such there is no social or communal prejudice in the rearing of the worm. Experience, however, shows that good quality yarn is obtained if the pupae are removed before emergence of the moths.

The silk cocoons have to be boiled before spinning and either washing soda or wood ashes are used as clarifying agents. Sunlight soap is now-a-days more conveniently used. The ratio of cocoon to fibre is 4 : 3 and the yarn is not appreciably affected by the type of the food plant, i.e. either the white or the red type of castor, but the latter is found to be more suitable.

The usual colour of the cocoons is white or light brown. This is independent of the colour of the caterpillars or the type of food plant.

There is a large trade in silk and the *eri* cocoons, and big quantities are exported to Calcutta, Bhutan and the Punjab. Seers and maunds are weight units for buying or selling of the *eri* silk cocoon or fibre.

As for other details regarding *eri* silk worms, it can be said that each female is capable of laying 200 to 300 eggs, also known as seeds, after a mating of 12 hours or so. But in order to get healthier caterpillars, the pairing male and female moths should be separated after they have mated continuously for 6 to 8 hours. To facilitate this, and also in the usual procedure, the mating females are tied on warping reels (*ugha*) or on thin rolls of thatch or straw with the help of a fine string around the shoulder joints of their right wings. The oviposition period should not, in any case, be allowed to go longer than 24 hours, as the eggs laid after that period are not at all dependable for seed purposes.

The eggs are then picked up one by one and wrapped up in a bit of fine cloth, which is kept hanging in ant-proof room and whitish thin caterpillars hatch out of them in a week's time. The larval period covers 3 to 4 weeks. The pupal stage of the cocoon continues for 3 weeks. Thus the total life cycle is between 7 to 8 weeks. But in winter all the stages are longer. Dry *chompat* (*Machilus* sp.) or bamboo leaves are conveniently used for the formation of cocoons.

In the process of rearing which is generally done indoors overlapping broods may be kept. In the Upper Assam, the leaves of another less important food plant known as *kecheru* (*Heteropauax fragrans*) are used for rearing the caterpillars. Where the rearer is short of food plant for his worms, he has to buy the leaves sometimes from distant villages. But it is expected that the plantation of improved types of castor will be taken up by both the Agriculture as well as the Industry Departments as it will serve the two fold purpose of extending the rearing of *eri* silk worm on leaves and the castor seed produced will serve the purpose of yielding oil for lighting purposes as there is a dearth of kerosene oil. The castor cake obtained after extraction of oil from the seeds will also add to the manurial resources of the province.

## HYBRID RUBBER PLANT

A HYBRID hevea rubber plant which is resistant to South American leaf blight has been developed by the Brazilian Ministry of Agriculture in collaboration with foreign scientists, a British trade magazine reports. The seedlings have been produced as the result of hand pollinations crossing susceptible Oriental strains and the best and most resistant selections produced in earlier years on a scientific plantation in Brazil.

Five of the crosses have produced plants that are highly resistant to blight, are vigorous growers, and possess desirable trunk and branching qualities, according to one of the Brazilian scientists engaged in the work. It is hoped that further propagation will bring out hybrids more productive than the best of the Far East.—*Foreign Commerce Weekly*, 27 May, 1944.

# DAIRY INDUSTRY IN THE PUNJAB

## I. FODDER PROBLEMS

By

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and

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INDIA possesses the largest cattle population of all countries in the world. Of the world cattle population of about 730 millions, 230 millions, i.e. nearly one-third, are found in British India. Next in order are the Soviet Union (65 millions) and the United States (58 millions), each possessing not even a third of India's total cattle population. Great Britain has only 7 million animals, or one-thirtieth of the cattle in India.

A question may easily arise as to whether all these cattle are actually needed or a large number of them are really superfluous. It is universally recognized that most of the cattle n India are miserably underfed which is hardly surprising in view of the figures given above. It is therefore obviously clear that either the number of cattle is redundant or there is a considerable shortage of fodder in the country. Both these points of view need examination. To bring the Indian cattle industry on a sound footing, it would be necessary to (a) reduce the total number of cattle; and/or (b) increase the total production of fodder.

Concerted action is of course required to weed out or segregate all non-descript, useless and mongrel cattle. Religious objections exist no doubt about the wholesale destruction of old cows and decrepit bullocks. The best way to effect this is to stop promiscuous breeding by scrub bulls in the villages by starting a regular campaign for extensive castration. This should be supplemented by educating the people to keep fewer but better cattle which should be able to give as much or perhaps better service than a large herd composed of unimproved or useless animals.

There are three essential uses of cattle in India : (i) for milk and other dairy products ; (ii) for ploughing, transport and other agricultural work ; (iii) for manure and fuel.

### *Milk production*

Although, unlike other countries, item No. (ii) is as important as No. (i), it will be clear from the figures given below that the production and consumption of milk in India is deplorably low. Its inadequacy and non-availability are adversely affecting the health of the people.

The total annual output of milk in India is 7,436 lakh md. When compared with other countries, India stands second in volume of milk production, her output being exceeded only by the United States of America with an annual milk production of 12,532 lakh md. But owing to the density of its human population and the vastness of its area, the daily per capita consumption of milk in India is extremely low. Estimates indicate that the average consumption per person per day in India does not exceed 5·8 oz. This may be compared to the consumption in other countries, given below[1] :

| | | |
|---|---|---|
| 1 | Great Britain .. .. .. | 40·7 oz. |
| 2 | U.S.A. .. .. .. | 35·6 „ |
| 3 | Australia .. .. .. | 44·4 „ |
| 4 | Newzealand .. .. .. | 55·6 „ |
| 5 | Denmark .. .. .. | 40·3 „ |
| 6 | Germany .. .. .. | 35·0 „ |

According to existing dietary standards the quantity of milk required for the maintenance of satisfactory growth and health ranges between 20 and 30 oz. per person per day. Though the consumption of milk in the Punjab is one of the highest of all provinces in India, yet it falls short of the standard, being only 15·2 oz. per person per day.

There is, probably, no single measure which would prove more helpful in increasing and cheapening milk production in India than the improvement of its cattle. Results of recent provincial marketing surveys show that the

[1] Report on the Marketing of Milk in India and Burma, 2nd ed., pages 55, 58.

average milk yield per annum of village cattle in British India is only 525 lb. for cows and 1,270 lb. for buffaloes. The average yield in the Punjab where the cattle are much superior is 1,445 lb. for cows and 2,320 lb. for buffaloes. Against this the average milk production per cow in Great Britain, the U.S.A. and Denmark stands at 5,576, 4,126 and 7,005 lb. per annum respectively. Again there are 50 cows and 78 buffaloes in milk or 128 milch animals for every 1,000 persons in the Punjab as compared to 20 cows in America and 25 in England.

It must be realized that India has a very large cattle population, more than that of any other continent, not to speak of any individual country. The dairy quality of the cattle within the boundaries of India itself varies so extensively that it is highly misleading to compare Indian cattle[1] as a class in point of milk yields with small lots of specialized dairy cattle in countries abroad, some of which have been improving their yields for the last 50 years, if not more.

## *Wanted better cattle*

It will not, however, be an exaggeration to say that India possesses some excellent breeds of cattle for milk production, e.g. Sahiwal and Red Sindhi, some of the best bred animals of which have yielded at the Government Dairy Farms in India over 10,000 lb. of milk in one lactation. It is an admitted fact that owing to lack of education among the majority of stockmen in India, which generally results in unscientific feeding and indiscriminate breeding, the various types of cattle have deteriorated both in quality and in utility.

The Indian cattle can be considerably improved by careful selection and judicious culling. A small dairy farm attached to the Punjab Agricultural College, Lyallpur, started work in 1913-14 with about 10 cows of the Sahiwal breed purchased locally. The overall average of the herd was only 5·6 lb. The dairy farm retained its own heifers in the herd, and by careful selection and selective breeding coupled, of course, with scientific feeding, the herd has been improved to such an extent that the overall average yield of milk jumped up to 9·3 lb., 15·05 lb. and 17·13 lb. after spans of 10, 20 and 25 years respectively.

It is needless to say that by far the most important cause of deterioration of Indian cattle is poor feeding. Dr Wright, in his report on the development of the cattle and dairy industries in India, has stated : 'There is no doubt that the majority of Indian cattle are seriously underfed......It may indeed be stated that inadequate nutrition is at present the most important single factor accounting for the low yields of country cows'. The Royal Commission on Agriculture rightly remarked that: 'No substantial improvement in the way of breeding is possible until the cattle can be better fed'. If milk production is to be increased, the provision of a very much larger quantity of fodder supply than at present is essential. As a cow's food consists of fodders and concentrates, their existing supplies will have to be considerably augmented in order to attain the desired objective.

## *Concentrates and green fodder*

In order to keep milch cattle in good health and to enable them to produce the maximum quantity of milk, it is necessary to supplement the fodder with some concentrates. Whereas fodders are required to supply certain chemical compounds to keep the animals alive and in good health, the chief function of the concentrates is to supply concentrated energy required for milk secretion or work.

Since the vitamin contents of the fodders are ordinarily very high, it is not only economically advantageous but also good for the health of the cows to induce them to eat as much fodder as possible. The fodders, and in particular, the green forage play such an important role in the economy of feeding milch cattle that it is essential to feed them as much green fodder as possible. A continuous and regular supply of green fodder to the cow produces a very wholesome effect on the milk yield. This fact is suggested by the figures given below[2].

| Year | Green fodder fed per cow per day lb. | Dry fodder fed per day lb. | Concentrates fed per 100 lb. of milk | Average annual yield per cow lb. |
|---|---|---|---|---|
| 1931-32 | 45 | 6·1 | 52·35 | 4679 |
| 1932-33 | 38 | 5·9 | 59·30 | 4172 |
| 1933-34 | 62 | 2·9 | 52·19 | 5493 |
| 1934-35 | 69 | 2·5 | 52·06 | 6037 |

The figures stated above indicate that the larger consumption of green fodder by dairy cows of the Punjab Agricultural College, Lyallpur, may have been directly responsible for the greater quantity of milk produced by

[1] (Report on the Marketing of Milk in India and Burma, pages 17 and 18).

[2] Ref. Cost of Milk Production at Lyallpur, 1938.

them. It is needless to say that both physiologically and economically green fodder plays such an important role in the health and milk production of cows that any amount of stress laid on its increased production and use will not be out of place. A concerted attempt should, therefore, be made to augment the present supply with a definite determination to provide green fodder, at least to the milch cattle, throughout the year.

The chief source of fodder supply in the Punjab are : (i) Grazing grounds ; (ii) by-products from cereals and other commercial crops; (iii) fodder crops.

As a matter of fact there are no real grazing grounds in the Punjab. The wet and dry seasons are so sharply defined that the formation of permanent pasture is impossible, except under irrigation. Grazing pastures under irrigated conditions in a densely populated province like the Punjab are not economical. Owing to the increase in population, the pressure on land is increasing, and the size of the holdings is rapidly decreasing. The common lands in the plains, the so-called *shamlats*, are being brought under the plough bit by bit ; in many tracts they have completely vanished now.

There is thus very little scope for an increase in the area under pastures. Proper maintenance and economic utilization of the existing ones are the only alternatives. Each pasture should be divided into a number of small blocks which should be grazed by rotation and the number of animals grazing therein should be no more than could be properly maintained.

*By-products from cereals and other commercial crops:* Practically no improvement under this head is possible without effecting an improvement in the crops from which they are derived. With the introduction of better varieties of grain crops, such as wheat, barley, maize, *bajra*, etc., an increased quantity of straw and dry stalks can be expected. The cultivation of improved varieties of sugarcane will result in more green tops being available for animals.

*Fodder crops :* The area under fodder crops in the Punjab is about 48·7 lakh acres, i.e. about 16·8 per cent of the total cropped area. This is the most important source of cattle food. The cultivator can increase his fodder supply by :

(1) Putting more area under fodder crops;

(2) Growing high-yielding varieties of fodder crops ;

(3) Growing new fodder crops which may provide fodder at a time of the year when green fodder may not ordinarily be available.

The cultivator cannot possibly put more area under fodder crops beyond a certain limit as any addition to these crops would mean a decrease in the area under money crops. He must, therefore, resort to alternatives Nos. 2 and 3. By growing only those varieties of fodder crops which give high yields, he can substantially increase his fodder supply.

The Department of Agriculture, Punjab, has rendered a conspicuous service by introducing crops and varieties of crops that are not only suitable for special agronomic requirements and climatic conditions but give higher yields than the crops already under cultivation.

### *Crop rotation in the Punjab*

There are two main seasons of crop production in the Punjab :

(a) *Kharif* (summer crops),

(b) *Rabi* (winter crops).

Out of the total area under fodder crops in the Punjab, approximately two-thirds are put under *kharif* fodders and only one-third under *rabi* fodders. Efforts should be made in every case to substitute better varieties of crops for the unimproved types. The Department of Agriculture, Punjab, has a long list of crops which it recommends either for replacing the old varieties or as new introductions to augment the fodder supply at such times of the year when a scarcity of green fodder is specially felt.

Although the problem of fodder supply varies in different parts of the province according to the varied conditions of climate, irrigation facilities, soils, etc. there are two critical periods of acute scarcity in green fodder. These are the transitional periods from the *kharif* season to the *rabi* and vice versa, i.e. the periods of November-December and May-June. Late maturing varieties of oats, early-sown maize mixed with cowpeas, Sudan grass and teosinte can provide green forage during May and June. The scarcity of green fodder during the months of November and December can be overcome by late sown teosinte and maize mixed with cowpeas, supplemented by early turnips, Indian Colza and early berseem.

The following are some of the crops recommended by the Department of Agriculture, Punjab :

*Kharif crops :* (1) *Juar* (*Andropogon sorghum*). Type J.S. 20 gives a higher yield than common *juars* and is more resistant to the attack of certain fungus diseases. Being an insipid type it can be dried and stored for long periods

It is, therefore, a very suitable variety for cultivation in *barani* areas where storage of fodder is most essential. Another new type, J.S. 21, is the heaviest yielder and is sweet. It has done very well under *barani* conditions in the Pothwar plateau (area situated north of the Salt Range).

(2) *Sudan grass* (*Andropogon sorghum* var. *Sudanensis*) was introduced in the Punjab only recently. It gives as many as four cuttings of nutritious fodder during the summer season when grown under favourable soil and irrigation conditions.

(3) *Teosinte* (*Euchlaena mexicana*) is becoming popular in several districts of the province and is a new introduction. If sown in March it gives 2 to 3 cuttings during the summer season, but if sown late, i.e. towards the end of July or in early August, it gives a very heavy yield of fodder in October and November. This fodder crop thus serves at either of the critical periods when the scarcity of fodder is acute. The fodder is succulent and nutritious and is relished by all kinds of stock. It is not attacked by the common borer and is also resistant to fungus diseases.

(4) *Cowpea* (*Vigna smensis*). Fo.S. No. 1 is an excellent high yielding forage crop. It makes a very good mixture with teosinte and maize and, being rich in protein, improves the quality of fodder.

*Rabi crops.* (1) *Oats* (*Avena sativa*). The introduction and evolution of the late maturing types of oats have made this crop very popular. They provide green fodder during April and May. The Algerian oats and Fo.S. 1/29 have given very good yields in the comparatively drier areas, whereas French oats do well under conditions of high humidity and copious irrigation. Fo.S. 1/29 is a drought resistant type and does well under purely *barani* conditions. Oats provide very nutritious fodder. They are admirably suited for quick conditioning of livestock and for increasing the milk flow. They should therefore be grown by horse and cattle breeders and dairymen alike.

(2) *Berseem* (*Trifolium alexandrinum*), which was introduced some years ago, has become very popular and is replacing *senji* (*Melilotus parviflora*), the only important leguminous *rabi* fodder grown in the Punjab. Berseem is capable of supplying large quantities of green fodder in 4 or 5 cuttings from December to May. The fodder is very rich in proteins and is relished by all kinds of livestock. It augments the milk flow when fed to dairy cattle. If it is to be sown for the first time in a new field, the soil requires bacterial inoculation, advice regarding which is obtainable from the Agricultural Bacteriologist, Punjab Agricultural College, Lyallpur.

(3) *Japan rape* (White leaved *Brassica napus*) is the heaviest yielder of fodder amongst the Indian Colza varieties. It can be cultivated very profitably on light loams in the *barani* areas. In addition to supplying fodder and oil, which is extracted from its seed, it is also largely used in the villages for human consumption as vegetable *sag* which is very palatable and is highly relished.

A number of cultivated perennial grasses have also been successfully introduced, chief among which are Guinea (*Panicum maximum*), Napier (*Pennisetum purpureum*) and Rhodes (*Chloris gayana*) grasses. All these can be successfully cultivated wherever irrigation water is available and give high yields in a number of cuttings all the year round. Napier grass can grow and produce fair crops under dry farming conditions as well.

### *Fodder conservation*

It is commonly observed that when, on account of timely and adequate rainfall, the cultivator is able to produce more fodder than he immediately requires he forgets all about his worries at the time of scarcity. He feeds it to the animals without chaffing, with the result that only the leafy and soft portions of the plants are eaten, the comparatively hard stems go to the manure pits. All this waste can be avoided by the use of a chaff cutter. Fodder saved may be stored for future use when necessity arises. It may be turned into hay or silage.

The Royal Commission on Agriculture laid great stress on silage making. Silage is of considerable use to the cultivators of the *barani* areas who have no fresh and succulent fodder or herbage available for their cattle during the summer season. As the Royal Commission stated: Small rations of silage fed to the hungry cows and young stock of the country during the season of fodder shortage would, we think, do more than anything else to bring about a rapid change in the quality of Indian cattle. The earthen pit is the cheapest form of silo, best suited to our conditions ; when properly constructed, fodder will keep as well, if not better, in this type of silo if it is well pressed during filling than in the tower silo built of bricks or concrete.

Silage, however, is not the only way of conserving fodder. Hay making is an alternative for those who cannot prepare good silage. The climate of India is such that no difficulty is ordinarily experienced in the making of hay. Hay keeps better than silage when it is necessary to transport it to distant places.

It will thus be seen that by following the recommendations of the Agricultural Department in connection with the cultivation of improved fodder crops and by increased economy in feeding, by the conversion of surplus fodder into silage or hay, the dearth of fodder can be considerably reduced and the foundation can be firmly laid for a more enhanced milk production in India.

## NEW BUTTER-SPREAD PRODUCT — AUSTRALIA

TROPICAL butter-fat spread is manufactured from creamery butter. This is melted with live steam, and the melted butter is run into large neutralizing and mixing vats. After neutralization has taken place, the melted butter is run through high-speed centrifuges where the pure-dry butterfat is separated from the water, salt and curd. The pure fat is then boiled under vacuum and partly cooled before being run into the mixing vat. To the pure butterfat is added a small quantity of finely powdered salt, skim milk powder, diacetyl flavouring, and 19 per cent of hydrogenated butterfat, which increases the melting point of the product to about 105 degrees F. Even if higher temperatures are encountered and the product should melt, thus causing the salt and skim milk powder to settle out, these ingredients can easily be re-incorporated by stirring. The working out of the process adds another item to the long list of important discoveries that Australian scientists have made under the stimulus of war. Apart from the centrifuges, the whole of the plant and machinery for the equipping of the factory in which tropical butterfat spread is being manufactured was made in Australia.

A 'New Way' butter machine has been shipped to London for use in the reconstitution of dried fat into commercial butter. According to the Commonwealth Supervisor of Dairy Exports (Mr F. Wigan), a grading panel of the British Ministry of Food has declared a sample, reconstituted in Australia, as of 93 points choicest quality and quite equal to normal butter. The 'New Way' machinery is an Australian invention and has been in operation for packing the butter in 56 lb. box size and 1 lb. and ½ lb. pats. The ½ lb. pats, Mr Wigan expects, will be most in demand in England, as it is convenient for cutting into halves and so providing the rationed unit.

Some comment has been made by officers of the Department of Commerce on the lack of distinctive flavours in butter from many Australian butter factories. One authority on butter claims that this is mainly brought about by the modern methods of cream pasteurization, because most factories today are using direct steam pasteurization under vacuum, and steam coming in direct contact with the fat globules of butter carries off odours. The advantage in using this method of butter manufacture was that it enabled it to be kept in cold store for longer periods without deterioration.—*Dairy News Letter, Canada*, May, 1944.

# What the Scientists are doing

## SURRA

SURRA is the name given to a wasting disease of animals produced by a microscopical blood-inhabiting protozoal organism known to zoologists as *Trypanosoma evansi*. Although this small parasite is very similar in appearance to that which produces sleeping-sickness in man in Africa, they are not identical since sleeping-sickness and surra are not intercommunicable to man and animals.

In this country, camels, horses, cattle, dogs and other animals are known to be more or less equally affected by surra. In camels the disease has a chronic course, and the animal may suffer for six months or as long as three or four years. It ultimately dies. With horses, on the other hand, the disease has a duration of a few weeks to a few months, while in cattle it may either suddenly appear as a serious outbreak causing heavy mortality within a very short period or the parasites may remain in the body in a dormant state for some length of time. Such animals, however, are a danger to an animal population, since they serve as carriers or reservoirs of the disease.

It is now well recognized that surra infection spreads from animal to animal mechanically through the bite of blood-sucking species of flies such as *Tabanids* (horse flies), *Stomoxys* (stable flies), etc. Possibly also, mosquitoes play a role in transmission, though this awaits experimental confirmation.

The most infallible means of knowing whether an animal is infected with surra is to look for the trypanosome in the circulating blood by examining a drop of blood under the microscope. This, however, is not a simple matter. For instance, at an early stage of the disease, when there are very few parasites in the circulating blood, one may fail to detect them by adopting the usual routine method employed in laboratories. In such cases other tests have to be employed,—there is for instance a more complicated test, known as the 'complement fixation' test. By this method latent carriers of surra in bovines can be detected fairly satisfactorily. Work on these lines is now in progress at the Imperial Veterinary Research Institute, Mukteswar.

Recently at Mukteswar it has been established that bovines can act as carriers for equines, that is to say, severe outbreaks in horses can be derived from apparently healthy cattle which are harbouring the parasite. Hence, the detection of 'carriers' in cattle and their effective treatment is an important factor in controlling surra in an affected area.

With regard to treatment, it has been found that if treatment is applied at an early stage of infection with drugs known to be capable of killing trypanosomes, such as 'Naganol' (Bayer 205) or 'Antrypol', the results are very satisfactory. It must, however, be noted that these drugs have to be used judiciously and in skilled hands. They must not be given in a dose which is insufficient to provide complete cure, otherwise the surviving parasites will become accustomed or tolerant to the drug so that subsequent doses will have no lethal effect on them. In scientific parlance, such parasites are described as being 'drug-fast', i.e. drug resistant. This is a most important matter when the problem of dealing with surra arises and it now seems that once a strain of trypanosomes has become drug-fast it can remain in this condition for several years so that treatment of the disease in a particular locality becomes ineffective. Transference of such resistant parasites from one animal to another does not appear to alter their characteristic drug-fast properties. Prior to this knowledge becoming available, it seems that in field practice we inadvertently have already produced a number of drug-fast strains of the parasite.

It may be pointed out that chemists now-a-days are constantly producing new drugs for the treatment of microbial disease. The Imperial Chemical Industries, London, for instance has recently produced several drugs which are known to be beneficial in cases of human trypanosome infection. Experiments designed to assess the trypanocidal (trypanosome-killing) value of some of these new products on equines infected with *Trypanosoma evansi* are now going on at the Imperial Veterinary Research Institute, Mukteswar. It is hoped that the results may be of assistance in the war effort of the country.

# What would you like to know?

*Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.*

**Q : What is the easy process of preservation of milk in its natural state ? How long can it be preserved ?**

A. Milk intended for laboratory work is preserved by addition of substances like formalin and perchloride of mercury in very small quantities. Milk can thus be maintained in a fluid state for over a week.

For human consumption, however, the use of such preservatives is not permitted. Milk which has been produced hygienically can be preserved by chilling to a low temperature and keeping it in cold condition (40° to 45°F.) for about a week. On the other hand, milk produced under insanitary conditions must be first heated to destroy the contained organisms and then cooled to a low temperature to prevent multiplication of the organisms which survive the heating process. This is commonly known as Pasteurization. Heating to 150°F for 30 minutes and then quickly cooling it to low temperature gives the desired results. The same results could be obtained with boiling but this may affect the nutritive value of milk to some extent.

**Q : Recently a heavy demand for *chana* has been felt and we are purchasing it from creamers. But we doubt some of them are adulterating with *makai* powder. So we want to know all possible ways of adulteration and their detection.**

A. *Makai* powder or any other starchy material, if used for adulteration of *chana*, can be detected by the addition of dilute solution of iodine, or potassium iodide, when the usual blue colour can be noticed. This is the only simple test and is easy to carry out.

**Q : How long does *chana* keep ? Is there any preservative for it ?**

A. Since *chana* contains lactose, proteins and moisture which are favourable for bacterial growth it is natural that *chana* will have poor keeping quality. The product develops acidity and hence sours rapidly. Even one day old *chana* will taste sour. On health grounds no preservative is allowed to be added to milk products required for human consumption.

**Q : What products, other than curd, could be made out of separated milk ?**

**We understand that casein could be made out of it and shall be glad to have particulars on the manufacturing process. How much will it pay us if we prepare casein from 100 lb. of separated milk ?**

A. The products which can be obtained from separated milk are :

(i) casein, (ii) cheese, (iii) *khoa*, (iv) sweetened condensed skim milk, (v) skim milk powder, and (vi) skim milk curd.

The manufacture of casein and cheese leaves whey as a by-product which could be used for preparing products like (i) whey molasses, (ii) whey powder, (iii) whey cheese, (iv) lactose (v) lactic acid, (vi) calcium lactate and (vii) mineral bricks.

There are two kinds of casein, namely, acid casein and rennet casein. The acid casein is of two types—lactic and grain curd. For the processes of manufacturing these kinds of products you should refer to the following publications obtainable from the Manager of Publications, Civil Lines, Delhi :

1. *Casein making in Gujerat* by Z. R. Kothavalla.
2. *Some Experiments on the Manufacture of Casein under Indian Conditions* by Annasamy and Paul.

The yield of casein from 100 lb. of separated milk is between 2·7 lb. and 3 lb. The cost of producing casein now would be high and very variable due to varying prices of raw materials and other articles required in different places. Nevertheless, it is a paying product as casein is, at present, sold at the high price of Rs. 4,000 per ton. In peace time, however, casein alone does not pay unless the whey obtained as a by-product is profitably used.

## THE PUNJAB

By Ch. Karam Rasul, B.Sc. Agri.(Pb.) Assoc. I.D.I., P.A.S.

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LIGHT to moderate but wide-spread rainfall in January and normal to above normal precipitation were received during February. The month of March remained warm but wide-spread moderate to heavy showers of rain were received towards the close which cooled down the atmosphere. Hail-storms were also experienced in some parts of the province.

### Crops

*Sugarcane:* The crop has met with a favourable year. The total area under the crop is 552,900 acres as against 447,000 acres last year, thus showing an increase of 24 per cent. On account of the high proportion of the area under improved varieties and the generally favourable season (except towards the end of March and beginning of April when the rains unusually delayed the crushing operations) the yield is above normal and the total outturn is estimated at 5,72,800 tons or 32 per cent more than that of last year, while *gur*-cane ratio which is 1:10 remains unaltered. The price of *gur* in the quarter under review fell considerably due to larger arrivals from the new crop and imports from the adjoining districts so much so that in the Lyallpur market the average price was Rs. 8-13 per md. as compared with Rs. 15 in the last quarter. When the price of *gur* went down to about Rs. 9 per md. no difficulty of cane-supply to the factories was felt. Although the price of *gur* was low in the second half of the season, yet the farmers have secured a good income on the whole, as compared with last year and this fact is likely to serve as an incentive for greater increase in area and cultivation and greater care of the crop next year.

*Cotton:* The position of the cotton crop with regard to area and yield as compared with the corresponding figures of the previous year is revealed in the table given below :

| | | British Punjab | | | Indian States | | |
|---|---|---|---|---|---|---|---|
| | | 1942-43 | 1943-44 | Percentage of increase (+) or decrease (−) over 1942-43 | 1942-43 | 1943-44 | Percentage of increase (+) or decrease (−) over 1942-43 |
| Area of cotton in acre | Total | 2,331,700 | 2,620,700 | +13 | 617,100 | 720,700 | +17 |
| | Amrican cotton | 1,575,400 | 1,850,500 | +18 | 374,200 | 438,800 | +17 |
| | *Desi* | 756,300 | 770,200 | +2 | 242,900 | 281,900 | +16 |
| Outturn of cotton in bales | Total | 998,500 | 1,053,600 | +6 | 272,200 | 311,500 | +15 |
| | Amrican cotton | 738,300 | 785,000 | +6 | 182,400 | 188,200 | +3 |
| | *Desi* | 260,200 | 268,600 | +3 | 89,800 | 123,300 | +27 |

It is evident that both in the British Punjab and the Indian States the area as well as the outturn of cotton have increased but the increase in the British Punjab is much more in case of American cotton than in *desi* cotton.

Taking the Lyallpur market as the basis the average price of American cotton during the quarter under review was about the same as that of the corresponding period last year, while the price of *desi* cotton was higher by about 40 per cent. The latter is attributed to the scarcity of *desi* cotton while the former to the import from Egypt and to price control. The comparatively higher price of *desi* cotton is likely to be reflected in increased area of this variety next year.

*Rice:* The area under cultivation is finally reported to be 1,258,100 acres, an increase of 14 per cent over last year's figure, while the outturn of husked rice is estimated at 426,400

tons or 9 per cent more than that of last year. The increase in acreage and yield is attributed to the realization of high profits last year, the progress of land reclamation operations and the generally favourable season.

*Oilseeds :* According to the second forecast the area under *rabi* oilseeds is reported to be 829,800 acres, a decrease of 5 per cent, and of linseed 33,800 acres or a decrease of 8 per cent from the actual area of each last year. Out of 829,800 acres, 265,400 acres have been returned under *toria*. The area under groundnut is 48,200 acres showing an increase of 10 per cent over last year's actual area.

*Gram :* The crop is reported to have been attacked by gram-blight and wilt in some places in the province. Rains received in the end of the quarter under review have also damaged the crop. The prospects of the crop appear to be dark.

*Wheat :* The area under wheat is estimated to be 9,896,700 acres which is 5 per cent less than the actual area lsat year. The decrease is attributed to the unfavourable weather at the time of sowing. The estimated area in Indian States, is 1,455,000 acres or 16 per cent less than that of last year. Whereas the rains in the months of January and February proved beneficial to the crop, those in the end of March have damaged the crop on the whole.

### Price control

The quarter is well marked for what may be said to be the first step towards the control of the prices of foodgrains. During the quarter under review the maximum price of *bajra* was fixed at Rs. 7-8 per md. in Mandi Bahaud-din and Abohar and that of *jowar* at Rs. 7 in Dera Ghazi Khan and Rohtak districts. From 3 April, 1944 the maximum wholesale price of fair average quality wheat has been fixed at Rs. 9-8 to Rs. 10-10 per md. with a premium of as. 4 per md. for superior quality produce while the price of coarse rice (that is *jhona* variety containing a mixture of whole and broken grains of which at least 50 per cent are whole grains) at Rs. 13-8 to Rs. 14-12, of gram between Rs. 7-10 and Rs. 8-10 and of barley at Rs. 6-10 to Rs. 7-10 per md. for various places in the province.

While considerable reduction of returns from farming was apprehended on account of the price-control the levels at which prices have been fixed are not likely to affect the farm economy of the province materially, particularly in view of the application of the same principle to other commodities as well.

### Steady progress

*Oil-seed section :* As a result of long continued research on linseed crop, which occupies an area of about 30,000 acres—about half in the Kangra Valley and the other half in the plains—in the Punjab, the section has been able to discover out of the 33 types isolated at Lyallpur the Punjab type No. 5 for general cultivation in the plains. This is a brown seeded type and has yielded about 13·22 md. against 10·84 md. per acre by local varieties. In addition, its seed is very bold and contains the highest percentage of oil of all the available brown seeded types. On account of its white-coloured flowers as compared with the generally coloured ones of other types it can be easily kept pure by roguing alone. The Department is multiplying its seed for distribution among intending growers.

### Beekeepers' conference

The most outstanding activity of the entomological section during the quarter under report is the holding of the Sixth All-India Beekeepers' Conference and Bee Exhibition at the invitation of the Punjab Government in which delegates including Englishmen and Americans from all over India participated. During the course of the deliberations it was revealed that in India where nature was so bountiful, honey worth only a few thousand rupees was being produced, whereas America's annual production was worth thirty crores of rupees. Heretofore, beekeeping was the privilege of the hill peasantry only but by 'summering' the *Apis indica* bees in Lyallpur, the Punjab Entomologists have opened up a new avenue for establishing the industry in the Punjab plains, nay in the plains all over India. The bees not only yield honey but also play an important role in the pollination of oilseed crops, vegetables and fruit-trees. It is reported that the yield of *toria* has increased by about 10 per cent with the provision of two additional colonies of *Apis indica* bees per acre.

*Agricultural Section :* The very high milk record established by a buffalo (Begum) of the Punjab Agricultural College herd which yielded 10182·75 lb. of milk in 365 days with a maximum of 50 lb. on one day in her 2nd lactation in 1943-44 indicates the possibilities of improvement

of buffaloes with judicious feeding, selective breeding and good management.

*One-day agricultural shows :* One of the new features of the activities of the Department of Agriculture, Punjab, is the holding of 'One-day Agricultural Shows' throughout the province. This activity will go a long way in bridging the gap between the laboratory and the field.

The Thal project intended to irrigate the dry areas of the province in the north-west is approaching its final stages and the construction of the Bhakra Dam is being contemplated.

Under the grow more food drive the Punjab has drawn up a scheme of 5,000 new wells fitted with Persian wheels costing Rs. 72 lakhs for the irrigation of 75,000 acres of *barani* land. This amount will be advanced by the provincial Government out of the grant given by the Central Government, and the farmers completing the construction of their wells within a year of receiving the grant will get a rebate of 20 per cent. In addition, the Punjab irrigation engineers continue courageously and successfully to run the canals by cutting down the normal margin of safety for the success of this campaign. The enhanced supply of water has accelerated the progress of land reclamation. It is estimated that in the Northern Administration alone 40,000 acres will be reclaimed annually. To give further impetus to the drive the Punjab Government has decided not to assess for another year the '*rauni*' charges or crop-rates on newly broken areas for watering during *kharif* 1944, if during *rabi* (1944-45) they are put under no crop or if a food crop is sown in them without further use of canal water.

In order to ameliorate the condition of the poor farmers the Punjab Government is contemplating a scheme for the utilization of the 'Peasants Welfare Fund' for opening cooperative stores in rural areas, starting new cottage industries, awarding scholarships to the sons of peasants in schools and colleges and for technical education abroad.

# ASSAM

By N. K. Das, L.Ag.(Hons.)
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A meeting of the Agricultural and Animal Husbandry Section of the Provincial Advisory Board for Development was held at Shillong on 28 and 29 April, with the Hon'ble Mr N. K. Dutta, Minister of Agriculture and Mr R. C. Woodford, Director of Agriculture, in the chair on the first and the second day respectively.

The Hon'ble Minister stressed the necessity of increasing agricultural production so that it would not only meet the requirements of the province but also leave a safe margin of surplus food. He also referred to the problem of livestock and said that effective steps should be taken to increase the livestock wealth of the province as well as to prevent the slaughter of certain categories of cattle. The Hon'ble Minister also referred to the present position in regard to the production of vegetables which has shown very considerable improvement and said that the necessity was still very great.

### *Important recommendations*

The Board made a number of recommendations for the consideration of the Government of Assam. The more important of these were for :

(i) the appointment of an Agricultural Engineer and the pushing forward of the development of water control, primarily for rice ;

(ii) the constitution of a separate department of rural development ;

(iii) the inclusion of increased production of goats, poultry and eggs in the grow more food schemes for 1945-46 ;

(iv) the submission to the Imperial Council of Agricultural Research of a scheme for controlling helminthic infections of domestic animals ;

(v) the production of improved seeds of a wider range of crops than is being done at present by the Department of Agriculture, with special attention to pulses, mustard and potato ;

(vi) the establishment of more seed farms ;

(vii) the improvement of grazing lands ; and

(viii) the appointment of a special officer in the Department of Agriculture for preparing definite proposals and estimates for the post-war agricultural reconstruction.

The Board also considered the grow more food schemes for the year 1944-45 and recorded the opinion that these were not adequate and that increased provision should be made in the next year's schemes under different heads. The Board particularly recommended that efforts should be made to make Assam self-sufficient in pulses and *gur* (jaggery).

### *Grow more food compaign*

The estimated gross cost of the various grow more food schemes for 1944-45 is Rs. 22,30,502, as detailed below :

| | | |
|---|---|---|
| Seed distribution and storage | .. | Rs. 15,17,900 |
| Manure distribution .. | .. | „ 2,94,200 |
| Irrigation (small projects) scheme | .. | „ 2,42,000[1] |
| Temporary staff .. | .. | „ 1,76,402 |

In addition, approximately Rs. 45,600 have been provided for vegetable seeds and Rs. 18,000 for bullock-power sugarcane crushers in the ordinary budget of the Department of Agriculture.

In reviewing the progress of the grow more food campaign up to 30 November, 1943, the Director of Agriculture said in a report that between 1939-40 and 1943-44 Assam had achieved the following :

Increased area under rice by 19 per cent or 103,612 acres and rice production by 26·1 per cent or 464,884 tons.

Increased area under pulses by 6 per cent or 14,900 acres in 1942-43 (1943-44 figures are not yet available).

Increased area under sugarcane by 17·1 per cent or 6,600 acres and production by 34·2 per cent or 12,800 tons (*gur*).

Increased area under vegetables and potatoes by 38 per cent or 174,000 acres in 1942-43 (1943-44 figures are not yet available).

Provided water control to 553 square miles of rice or 3,53,920 acres thereby increasing production by about 58,987 tons of paddy or 36,867 tons of rice (40 tons paddy taken as equivalent to 25 tons of rice).

Substituted food crops for jute over about 40 per cent of the area under jute.

*Increased production of vegetables :* A very clear indication of the large increase in the cultivation of summer vegetables, specially English vegetables, in the Khasi and Jaintia Hills is furnished by the fact that in June the Army purchased over 3,000 md. of fresh English type vegetables daily in Shillong for supply to hospitals of the 14th Army. This is about eight times the quantity obtainable last year. The Khasi cultivators in these hills have responded wonderfully to the emergency.

[1] This scheme provides for small projects which can be carr.ed out without expert engineering knowledge.

### *Embargo on slaughter of livestock*

The position of the province in regard to the supply of livestock—particularly cattle—is not very strong. Even in normal times the province has to depend to some extent on imported cattle for the supply of power needed for agricultural operations. An order has, therefore, been issued recently under the Defence of India Rules, at the instance of the Director of Agriculture, Assam, putting an embargo on the slaughter of the following categories of livestock for the purpose of consumption in order to protect the young stock, while allowing the demand to fall on the class of cattle that can best be spared :

(a) any cattle or buffalo below the age of ten years ;

(b) any cow in milk or pregnant, whether below the age of ten years or not ; and

(c) any sheep or goat under the age of 2½ or 2 years, respectively.

Also, in order to protect breeding stock and maintain supplies of meat, poultry and eggs, an order has been issued empowering district magistrates to put certain restrictions on the sale of cattle, sheep, goats, pigs, fowls or ducks for the purpose of consumption.

### *Multiplication of improved rice seed*

The Department of Agriculture has some thirty improved varieties of rice. For want of any comprehensive scheme for the multiplication of pure seed on a large scale, the work of bringing the existing rice area under improved varieties has not hitherto made such progress as might be desired. The Department initiated last year a scheme under which pure seed produced on the departmental rice farms is issued to selected cultivators at market rate or on the return system. The seed produced by them is purchased by the Department at market rate *plus* a premium varying from 2 to 8 annas for re-issue to ordinary cultivators. But even this scheme was considered inadequate to meet the needs, and a larger scheme to expedite the progress of the work in view was submitted to the Imperial Council of Agricultural Research. The number of selected varieties has been reduced to 12 for the purpose of this scheme.

# TRAVANCORE

By O. C. Zachariah, B.Ag.
*Manager, Office of the Director of Agriculture, Trivandrum*

The Government of His Highness the Maharaja have been pleased to sanction a number of schemes under the 'Grow more food' campaign for increasing the food production in the State. The schemes are being pushed forward as vigorously as possible with encouraging results. It is hoped that the results of the schemes would relieve to some extent the food problem facing the country.

## *Nightsoil and street refuse compost*

A scheme to manufacture compost manure with town refuse and night-soil on a large scale and with up-to-date methods throughout the State in collaboration with the Imperial Council of Agricultural Research has been put into operation. A special officer, who has undergone training recently in compost making, has been appointed for the work. Arrangements are in progress for large-scale compost production in all the municipal towns and markets in the State. Work has already been started in a few municipalities.

Another scheme to make large quantities of compost manure from leaf-mould obtained from the Reserve Forest areas has been sanctioned. Eight centres have been selected in the Reserve Forest areas for the above purpose and the work is being pushed forward. Vigorous propaganda is being carried on by the officers of the Agricultural Department to make compost with sweepings and dry leaves available in each house in the villages.

So successful has been this propaganda that the quantity of compost made supplements to a large extent the deficiency in farmyard manure. Arrangements are being made to conserve farmyard manure available with the ryots on up-to-date lines so that its quality and quantity may be improved.

The Department has started a green manure plantation in south Travancore and about 100 acres have been planted with green manure trees. Ryots are being advised by the propaganda staff of the Agricultural Department to plant quick growing green manure trees in all suitable waste lands and along the boundaries of the holdings.

## *Artificial fertilizers*

The manufacture of chemical fertilizers like ammonium sulphate, etc. is under the active consideration of the Government and it may become an accomplished fact in the near future. A company has already been floated for the purpose.

Export of bones, oilcakes, fish manure, etc. has been prohibited. Bone crushing factories have been started in the State.

Manure depots have been opened in various parts of the State by the Agricultural Department and manures like groundnut oilcake, bonemeal, ammonium sulphate, etc to the value of Rs. 400,000 have been obtained from British India and stocked in these depots. They are being sold to the ryots both for cash and on credit. Sales are encouraging. Arrangements are also being made for replenishing the stock of these manures by further supplies when required.

## *Extension of cultivation*

Ten thousand acres of lake reclamation in Kuttsnadu areas which were under biennial cultivation have been made annual at the instance of Government. A special officer has been appointed for these areas to render all facilities and help to the ryots in effecting the cultivation properly and promptly.

Under the Lift Irrigation Scheme, single paddy crop lands in north Travancore are being converted into double crop lands with the aid of power from Pallivasal Hydro-electric station. Possibilities of the scheme are being demonstrated to the ryots in different localities during each season and the work is in progress. Manures required for the cultivation are given to the ryots on credit on crop loan basis. Altogether about 1000 acres have been brought under the scheme. A Lift Irrigation Special Officer with a staff has been appointed for this work. Ryots, being fully convinced of its success, are bringing in more land under the scheme each season.

Five thousand acres of minor forest reserves have been released for growing food crops and these lands are being leased out to interested ryots for periods ranging from three to seven years and the cultivation is in progress.

Extensive work under the 'Grow more food' campaign is being carried on by the district officers of this Department and as a result thereof, it is estimated that the area under tapioca alone has increased by 30 per cent. Every bit of land available with the ryot is being put under tapioca or other food crops with better system of manuring as advocated by the department.

A scheme to grow pulses in the paddy lands in south Travancore during the off-season after the harvest of *kumbhom* paddy was put into operation. In the previous years these lands were being left fallow till the next paddy cultivation.

Under a scheme under the grow more vegetable campaign for the cultivation of vegetables on water free areas in the irrigation tank-beds land was leased out to interested ryots and cultivation effected under the control and guidance of the Agricultural Department during last year. This kind of work is becoming popular among the ryots. Arrangements are being made to start the cultivation on a large scale sufficiently early this year.

### *Implements on hire-purchase system*

Hire-purchase facilities have been provided to ryots for improved implements and are being availed of by many.

The export of tapioca in all forms has been prohibited. Milling of paddy also has been prohibited in the State and vigorous propaganda is being successfully carried on, stressing the superior merit of hand-pounded rice.

### *Rural centres*

Rural centres in different parts of the State have been opened. Planned production, on a five year basis is being demonstrated by officers of the department. At present 26 such centres are functioning in various localities of the State and there is an all round progress in the activities connected with rural development work and the 'Grow more food' campaign.

## KASHMIR

By J. L. Raina, M.Sc.
*Senior Entomological Assistant, Department of Agriculture, Kashmir*

KASHMIR will be in a position to supply about 5,000 md. of seeds of certain European vegetables to India to make up the deficiency caused by the non-availability of such seeds direct from abroad. This has been made possible due to the close cooperation of His Highness's Government with the Government of India.

During the year 1942-43 an experimental vegetable seed scheme was started in Kashmir under the auspices and the financial support of the Imperial Council of Agricultural Research. The scheme proved a success and seeds worth about Rs. 3 lakhs were exported to British India.

In July last the Director of Agricultural Production (Food), Government of India, visited Kashmir and discussed the possibilities of further expansion of seed production with the Revenue Minister. As a result of these discussions, the Government of India agreed to finance in part a fresh scheme. By the end of December 1943, about 1,500 acres of land were put under these seed farms.

The farmers engaged in seed production have formed an Association called 'Kashmir Cooperative Nursery Seed Growers' Association Ltd'. The aims and objects of this Association are : (1) To develop, assist and coordinate the activities of its members in raising vegetable and agricultural seeds, and seed plants of standard quality. (2) To arrange adequate supervision of the raising of seeds and seed plants by its members, with the assistance of Agricultural Department. (3) To facilitate the sale of such seeds and seed plants raised by its members as have been certified to be of standard quality for multiplication.

As far as the actual working in the farms is concerned definite progress has been made in raising vegetable stock for seed. Big stretches of cabbage, knol-kohl, turnip, carrot, leek-beet, radish, parsnip and parsley are visible. The Director of Agriculture with his subordinate staff is busy giving the necessary instruction to the farmers. It is expected that about 5,000 md. of seed, worth Rs. 35 lakhs will be produced.

### *Fruit plant distribution*

The efforts of the entomological staff have resulted in the production of healthy fruit, free from insect blemishes. The price of fruit, especially of apple, has gone up by 100 to 200 per cent during the last two years. Farmers are now anxious to lay every possible acre of suitable land under fruit cultivation. A demand for 2 million fruit plants has been received from them by the Department of Agriculture. Due to the limited number of plants available, the Department is not able to meet the demand in full.

An encouraging feature is that keeping in view the limitations of the department, the farmers have undertaken to start their own nurseries. Thus another agricultural industry, viz. plant-raising has been developed.

### *Entomology*

Campaign against the two destructive insect pests of fruit plants, viz. San Jose Scale and Woolly Aphis, is in full swing at this season of the year. The departmental staff is busy spraying the plants with diesel oil emulsion.

As a result of the research work on San Jose Scale and Woolly Aphis, carried on under the auspices of the Imperial Council of Agricultural Research the quantity of soap as emulsifying agent has been reduced to half without affecting the efficacy of the insecticide. This reduction has resulted in a saving of Rs. 5,000 to the orchardists.

# MILK RECORDING NEWS

RECORDS for lactations completed during May 1944 have been received from three village milk recording schemes. Twenty cows and 50 buffaloes completed their lactations averaging 2,483 and 4,335 lb. respectively. The highest yield for a cow was 3,872 lb. and for a buffalo 7,196 lb. Records for each breed are given below:

### *Murah buffaloes*

Meham area, Rohtak district, Punjab. Twenty-nine buffaloes completed their lactations averaging 5,170 lb. The maximum yield was 7,196 lb. and the minimum yield was 3,780 lb. Selected records are as under:

| Brand No. | Name of owner | No. of lacta-tion completed | Date of calving | Days in milk | Lacta-tion yield lb. | Maxi-mum daily re-corded yield lb. |
|---|---|---|---|---|---|---|
| MI.165 | Jai Lal S/o Saliga | 5 | 23.10.43 | 316 | 5,905 | |
| MA. 19 | Lahri S/o Surjan | 4 | 20. 7.43 | 294 | 7,196 | |
| MA. 25 | Hira S/o Milkhram | 4 | 25. 7.43 | 285 | 5,760 | |
| MA. 77 | Chaadgi S/o Sobha | 5 | 27. 7.43 | 279 | 5,916 | |
| MA. 9 | Bakhtavar S/o Munhora | 5 | 20. 8.43 | 270 | 6,000 | |
| MA. 1 | Kundan S/o Lekhram | 7 | 20 8.43 | 270 | 6,000 | |
| MA. 20 | Shau Datt S/o Sukhia | 3 | 28. 8.43 | 270 | 5,550 | |
| MA. 85 | Sisram Pal S/o Anwar | 1 | 22. 8.43 | 270 | 5,490 | |
| MA. 94 | Raja Ram S/o Bhola | 7 | 23. 7.43 | 285 | 5,670 | |
| MA.106 | Choodgi S/o Ram Nath | 3 | 2. 8.43 | 285 | 5,814 | |
| MA.175 | Badloo S/o Jai Dyal | 5 | 26. 7.43 | 280 | 5,712 | |
| MA.173 | Choodgi S/o Pitram | 7 | 25. 8.43 | 266 | 5,404 | |
| MA.275 | Net Singh S/o Makhvool | 7 | 27. 8.43 | 288 | 5,508 | |
| MA. 87 | Pitram S/o Mohipat | 2 | 1. 7.43 | 290 | 5,800 | |
| MA.100 | Parbhoo S/o Hazari | 5 | 26. 7.43 | 300 | 6,030 | |

### *Local buffaloes*

Chata area, Muttra district, United Provinces. Twenty-one buffaloes completed their lactations in May 1944, averaging 3,181 lb. with a maximum yield of 6,285 lb. and a minimum yield of 1,746 lb. Selected records are as under:

| Brand No. | Name of owner | No. of lacta-tion completed | Date of calving | Days in milk | Lacta-tion yield lb. | Maxi-mum daily re-corded yield lb. |
|---|---|---|---|---|---|---|
| 57 | Shanker | 4 | 1. 8.43 | 274 | 3,730 | 15 |
| 297 | Jiwan | 5 | 30. 6.43 | 326 | 3,912 | 17 |
| 104 | Bansi | 3 | 15. 7.43 | 307 | 3,965 | 16 |
| 229 | Khacharah | 3 | 12. 9.43 | 241 | 3,265 | 16 |
| 43 | Jorawar | 4 | 5. 7.43 | 307 | 3,942 | 19 |
| — | Sukhnandan | 3 | 3. 8.43 | 274 | 3,410 | 17 |

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 226 | Persadi | 3 | 18.9.42 | 230 | 6,285 | 20 |
| 223 | Barulal | 3 | 24.7.43 | 297 | 3,463 | 14 |
| 303 | Jasri | 3 | 5.8.43 | 287 | 3,452 | 16 |
| 30 | Buddha | 4 | 31.8.43 | 258 | 3,916 | 18 |

Local cows, Chata area, Muttra district, United Provinces. Only three cows completed their lactations yielding 943, 1086 and 2130 lb. in 253, 251 and 245 days.

### *Hariana cows*

Beri area, Rohtak district, Punjab. Seventeen cows completed their lactations in May. The average, maximum and minimum yields were 2,794, 3,872 and 1,292 lb. respectively. Selected records are given below:

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| BR.120 | Harnam S/o Ram Bax | 8 | 3.3.43 | 273 | 3,192 | 17 |
| GH. 19 | Shoenarain S/o Shadi | 8 | 2.8.43 | 280 | 3,120 | 21 |
| GH. 9 | Harisingh S/o Baldevsingh | 4 | 5.8.43 | 273 | 3,276 | 21 |
| DG. 1 | Ramsarup S/o Kanaia | 6 | 14.5.43 | 365 | 3,675 | 18 |
| DG. 6 | Tekchand S/o Harnam | 5 | 28.6.43 | 320 | 3,225 | 19 |
| DG.231 | Chandgi S/o Marsingh | 4 | 29.6.43 | 317 | 3,571 | 24 |
| G.Γ.251 | Bahala S/o Netram | 6 | 15.6.43 | 335 | 3,872 | 23 |
| DG.217 | Nanda S/o Hazari | 5 | 21.7.43 | 297 | 3,501 | 22 |

# The Month's Clip

## BRITAIN CASHES AN ASSET : SOIL FERTILITY

BRITAIN'S latest harvest was the greatest in her history, and yet she grew it with less agricultural land available than at any time since the country was developed.

The war-time food tonnage from British soil is 70 per cent up on peace-time figures, the acreage under the plough was 62 per cent up in 1943 and has since been increased. But land carrying crops and grass in 1943 was 2·8 per cent below pre-war—caused by demands on land for airfields, battle-training grounds and other military purposes.

Is such intensive farming—for *it is* intensive —using up the fertility of Britain's soil ?

Wheat yields, for example, have been averaging about 34 bushels to the acre. Quite a number of farms obtain even fifty or sixty. Sugar beet has been averaging 10 (long) tons ; and potatoes, in spite of large acreages necessarily grown on unsuitable ground, about 13,500 lb. Nitrogenous fertilizers (home-produced) have been freely used to stimulate both crop and grass yields. Little or no land has been allowed to lie idle in bare fallows. Is the soil being exploited ?

### Half-loaf better than no bread

As with most things that concern nature, there is no simple 'yes' or 'no' to this question. Land that was arable before the war and has since carried three or four straw crops in succession, must obviously suffer from such a drastic cropping system. In 1942 I saw many acres of barley on the lighter lands that were not doing well. Such lands need potash, and potash is one of the fertilizers very scarce in Britain. Most of it used to come from Germany or Alsace-Lorraine. British farmers have not worried seriously about this because the need for home-grown cereals has been so great that even a half-crop has been of more service to the nation than not growing one at all.

So, on many of the old arable acres, the soil has been exploited and fertility has suffered. Not, of course, to the extent of creating dust-bowls, or even to anything approaching erosion on a noticeable scale. But land has had to be farmed in a way it could not be worked for long without running into grave trouble. Britain is not deterred by that. She is digging deeply into her financial capital, and into that far more precious capital of young lives. There is no reason why the capital represented by soil fertility should be sacrosanct.

But, looking at Britain as a whole, the soil is probably in better heart, and in better condition for growing food, than before the war. For, in the difficult years for agriculture between the two wars, much more land was in permanent grass than under the plough. Most of the land carried not very good permanent grass, and some of it had become overdunged by the livestock that used it mostly as an exercising ground while they consumed imported foodstuffs.

### Britain's reserve fertiliiy

The plough was the very thing for grassland, of which about 7 million acres have been brought under cultivation.

This let air and light into the soil ; it destroyed pests of livestock and grassland ; and in some places, it enabled nitrogen stored up in the clover roots and the fertility from years of dunging to be converted into human food in the form of bumper grain crops. That fertility Britain has also, to a large extent, cashed ; but it represented a reserve, and in the majority of cases the soil is all the better for it being drawn up.

In due course those acres will go down, if they are properly fertilized, to better pasture than they ever were before ; for Britain, with her present population and existing knowledge, could never hope to be self-supporting in cereals. She will continue to be an importer of grain.

If she farms her land as it ought to be farmed after the war, she will have more of it in crops and less in grass than in the record low-level crop-acreage of the pre-war years. Her agriculture had become top-heavy on the side of too much grass, and, with recent knowledge, farmers know that to manage grass best, there must be more ploughing, and more temporary pasture that is ploughed up every now and

again, cropped, and then re-sown with grass. But grass and livestock farming must be the mainstay of British farming, on account of both climatic conditions and nutritional needs.

### *Back to real farming*

For Britain, therefore, the exigencies of war have done no serious general damage to the soil, and on balance have even improved it, through liming, draining, more thorough cultivation and phosphates. The nation has derived great advantages from this; for it has drawn upon the reserve of soil fertility and has gained invaluable food during the war. That fertility has now been cashed to a large extent. The individual farmer no longer possesses that dormant asset.

That, surely, is as it should be in wartime, when no one wants to profit out of the nation's hour of needs; and although farmers have their grumble from time to time, but with sons and brothers and friends dying in Italy, or eating out their hearts in captivity in the Far East, they know they are far from having the toughest time in this war. 'I let off some steam, like the rest', one of them admitted to me the other day, 'but don't think that farmers are so indifferent that they don't feel ashamed sometimes, when they get between the sheets at night.'

Moreover there is this: every true farmer knew in his heart before the war that serving up imported animal foodstuffs in the neglected grass fields was not really farming at all. Mixed farming, with livestock and the plough complementary to one another, has always been the background of British farming in its times of greatness.

Farmers know this. It looks as though the war is going to put them in a position to make a fresh start on those old traditional lines, and that is worth a lot of soil fertility cashed for a war in which all are making heroic sacrifices. —M.O.I.

## SOIL STUDY FOR SOUND AGRICULTURE

THROUGH scientific agriculture yields per man-day-acre in many parts of the world have been increased enormously, the area of adaptability of individual crops extended and soil productivity increased. The present emergency requires rapid expansion in the production of certain crops without waste of land, labour or materials. Our scientific knowledge of the adaptation and care of crops, livestock and of the responses of soils to management, needs to be put to work quickly. Unless such planning is based on a sound soil classification great and perhaps fatal risks to both soil and people are involved.

The main purpose of soil research is to determine the kind, yield and quality of plants that can be produced under different physically defined systems of management on various types of soil, and the reciprocal influence of these systems on the long-time productivity of the soil types. Not all soil researches are, or should be, directed toward this immediate end. Many are directed toward the discovery and clarification of fundamental principles of the science, which, in turn, are used in seeking solutions of practical problems of production and the maintenance of productivity.

An integral part of fundamental and applied soil research is soil classification. It is based upon the morphology (form and structure), genesis (origin and development), and geography of soils as disclosed through scientific research and surveys. At the same time, soil classification is a practical tool. The work is done with regard to the significance of soil characteristics and soil types to growing plants, management practices and land use. These two aspects of the work—the scientific and the practical—depend upon each other. Without a firm basis in science, soil classification and mapping become superficial and transitory; they have no general or permanent value. Without regard to the use of soil types in agricultural production they become academic and limited in application; farmers cannot use the results.

Soils vary greatly in their internal characteristics, e.g. structure and texture, as well as in regard to such external features as climate, relief, etc. There are thousands of soil types which often occur intermingled with one another. The observer must be able to recognize the soil type upon which he is recording his observations and making his experiments. Having made the observations accurately, he should classify the results according to properly defined soil types and develop principles for application in practical agriculture; specific recommendations regarding crops or management practices for an area of land can be made only when the type of soil is properly recognized.

Several soil types are usually found in one farm. To study systems of farm management and broader community problems of soil use,

a pattern of soil types must be dealt with as a whole. For such purposes, soil types are grouped into soil associations, each of which is defined in terms of the relative proportions of individual soil types and their pattern. Generally the most satisfactory and economical method of ensuring accurate recognition of soil types is through the use of soil maps, on which the boundaries of carefully defined soil types and associations have been drawn accurately from field observations. A common error in early soil classification arose from the observation of single soil characteristics without regard to the others with which they are associated.

The danger of associating certain crop adaptations and management responses with a single soil characteristic is perhaps the greatest hazard in applied soil science today. There is no direct relation between a single characteristic of soils and their productivity, adaptability for a specific crop, or response to a management practice. It is the combination of all its characteristics that gives a soil type its distinctive character and distinguishes one landscape from another.

The facts revealed by accurate observations are the essential building stones in classification. The scientist must not only observe and measure the significant characteristics but also study their relationship to one another and to the whole environmental range of living plants and animals.

The function of soil scientists is to determine the yield and quality of crops that can be obtained under several systems of management on various soils and the effect of these systems upon the long-time productivity of the soils. Although this is a big task itself, still more is needed for making definite recommendations to agricultural producers. And for this, soil scientists, including those engaged in soil classification, must cooperate closely with agronomists, horticulturists, pathologists and others dealing with management practices, plant growth and plant production.—C. E. Kellog, *in Agriculture in the Americas*, Vol. III, 1943.

## MOLASSES AS A CATTLE FEED

MOLASSES has for long been known to be a valuable feed for cattle. Over a third of the molasses produced by sugar factories in Europe is used for cattle feed. In the United States of America about 50 million gallons of molasses are used for feeding cattle annually. In India, however, no efforts have been made to tap this valuable source of cattle feed. There is a prejudice against the use of molasses as a cattle feed in India, based on the erroneous idea that molasses contains far too much lime. Actually, however, molasses contains far less lime than hays and other common feeding stuffs.

Experiments on the preparation and use of a cattle feed from molasses have been carried out at the Imperial Institute of Sugar Technology, Cawnpore, for the last five or six years. Feeding trials at numerous animal nutrition stations in different parts of India have shown that bago-molasses—a mixture containing equal parts of molasses and bagasse screenings—is an excellent cattle feed. The feed was relished by bullocks, milch-cows, buffaloes and horses, and no ill-effects were observed on any of the animals. An inadequate village diet for working bullocks can be improved by supplementing with bago-molasses without inducing any bad effect on the health of the animals. From an adequate ration of working bullocks, gram husk can economically be substituted by bago-molasses without any ill-effect.

There is an acute shortage of fodder in the country at the present time, particularly in the large towns. The manufacture of bago-molasses in sugar factories situated in or near such towns may help to alleviate this shortage to some extent, and at the same time, develop an industry subsidiary to the sugar industry. In order to demonstrate the possibilities of this, bago-molasses was produced on a semi-commercial scale in the Experimental Sugar Factory attached to the Imperial Institute of Sugar Technology in the season 1943-44. The method of manufacturing the feed is quite simple and is briefly described below:

*Coarse Bagasse screenings :* Two plates were removed from the underside of the bagasse elevator conveying the bagasse from the last mill to the boiler furnaces and in their place were fitted perforated plates. As the bagasse travelled up the elevator a portion of it, consisting of coarse screenings, dropped through the perforations and was discharged by means of a shoot into steel barrels. Approximately 2·7 md. of coarse screenings were obtained for every 100 md. of cane crushed. When screenings were not required the perforated sections were covered by sheet iron covers.

*Drying the screenings :* The coarse screenings thus obtained were spread in the sun for drying. Occasional raking and turning over hastens drying. Sun-dried screenings have about 47 per cent moisture, the process of drying being usually completed in one day.

*Fine bagasse screenings :* The sun-dried coarse bagasse screenings are finally sieved using hand screens (49 mesh), and stored for mixing with hot molasses. This second screening is necessary to safeguard against coarse and needle like pieces of bagasse finding their way into the feed and making it difficult for the animals to digest it.

*Mixing the feed :* The mixing was carried out in a horizontal magma mixer. The stirrer was propelled by a portable oil engine. It would have been cheaper and more convenient to have worked with an electric motor but none was available at that time in the factory.

A measured quantity of molasses was poured into the mixer and heated by coal fire. An equal weight of fine and dry screenings was then added and the lot thoroughly churned for 10 to 15 minutes. A homogeneous mixture of molasses and dry bagasse screenings was thus obtained. It was removed and sold to waiting customers. The capacity of the mixer was about 3 md. per charge, and with continuous working it would be possible to produce up to 30 md. of feed per day. But the production of fine screenings from the small factory was insufficient for such continuous working of the mixer. The average output per day was about 12 md.

Manufacture of the feed commenced in early January and continued till the end of February. About 600 md. of feed was produced. The entire quantity was sold at a price of Rs. 1-4 per md. The prevailing price of *bhusa* was about Rs. 3 per md. Being of a higher feeding value than *bhusa* it would have been possible to secure a much higher price for the feed, but this was not done as the object of the scheme was to popularize the feed. There was a keen demand for the feed. The productive capacity was inadequate to meet this demand in full and supplies had to be rationed. The consumers included all types and classes of cattle owners. There were *tongawallas*, milk-men (*ghosies*), *gawshalas*, buffalo owners and cattle farms. A quantity of the feed was also bought by the Cawnpore Municipality.

The quantity of bago-molasses produced and sold was small but has created a definite market for the product in Cawnpore and its environs. There is little doubt that Cawnpore alone can absorb all the bago-molasses which one big factory can produce.—*Sugar Notes*, 16 May 1944.

## DAIRY HERD IMPROVEMENT

PRESENT-DAY stud herds are fixed for breed-type and will breed true to that particular character, but they are very far from being stabilized in regard to production. Mr J. T. Armstrong, Chief Dairy Officer of the Tasmanian Agricultural Department, makes this comment in an article on Dairy Herd Improvement appearing in the November issue of the department's journal.

The early breeders (the article continues) possessed the decided advantage that the characters in which they were primarily interested were visible and easily recognized, whilst those whose goal is constant high production are dealing with an unseen attribute. The assessment of a cow's productive capacity is not, however, difficult. Few, if any, of our present-day cattle are pure-bred for high or for low production, practically all carry a mixed inheritance ; but it is fairly safe to assume that a cow which has established a high record under official test must carry most of the factors for high production and few for low production.

Recording, therefore, gives a fairly close insight into the genetic make-up of the cow, but greater difficulty is experienced in determining the genetic constitution of the bull ; and since the bull is used over the whole herd and is the source of half the heritable characteristics conferred on all the young stock, it is more essential to have a sound knowledge of his production factors than of those possessed by the cows. In time it may be possible for scientists to determine by microscopic examination of a germ cell whether or not a bull is a potential herd improver, but present knowledge does not extend so far and the value of a sire can only be assessed indirectly.

The method usually adopted is a study of the production records of the bull's sisters and half-sisters or, preferably, the more accurate but slower method of examining the records of his daughters as compared with those of their dams. In employing the latter method it is necessary that both sets of records be available. A knowledge of the daughter's records only will tend to be misleading. For instance, the records of the daughters of two different bulls may be compared, those of one bull averaging

400 lb. of butterfat whilst the daughters of the second animal averaged only 350 lb. Assessed on these records alone, the former bull would receive preference; but if the dams of the daughters averaging 400 lb. were found to have averaged 450 lb. whilst the dams of the other daughters had averaged only 300 lb. a quite different set of values would be placed on the two bulls. Further, in assessing the value of a bull from his daughters' performances, the records of all his heifers, not only those of selected animals, should be considered. A bull may sire twenty daughters, five of which are heavy producers and the remaining fifteen very moderate performers. The selection of that bull as a herd sire, based on the production of the five best daughters, would probably prove very disappointing. A bull, the majority of whose daughters are heavy producers, must, like the cow which achieves a high record, carry in his inheritance a marked preponderance of factors for heavy production and will be unlikely to sire many low producers.

The hope for an improvement in the average production of dairy herds must, therefore, hinge on the purification of high-class breeding stock for high production, employing sires whose records have shown them to be pure-bred or nearly pure-bred in this respect. Moreover, a bull which has been carefully selected should be retained until his daughters' records can be ascertained. The hindrance of progress which frequently results from the too hasty replacement of a good sire by one which subsequently proves inferior may thus be precluded. It is necessary, of course, that the observance of these principles be accompanied by the rigid culling from the breeding herd of all cattle which have failed, in a suitable environment, to give a satisfactory return.

Progress will be slow, but if the foregoing principles are adopted it is certain. On the other hand, no advancement is possible under the system of herd improvement commonly practised today.—*The Australian Dairy Review,* January 21, 1944.

## IMPROVEMENT IN REFRIGERATION

IT is reported from London that revolutionary processes for quick freezing of fruit, vegetables, fish and meat for everyday household use are being perfected at many laboratories and research stations.

The Ministry of Food and the food investigation board of the Department of Scientific and Industrial Research are examining preliminary reports from experts who are confident that Britain after the war will have an all-the-year-round supply of all staple foods. One of Britain's leading refrigeration experts said: ' The secret is that all these foods must be frozen solid and frozen quickly. Quick freezing does not take away any flavour or the vitamin value of foods.'

" Soft fruit such as strawberries and raspberries should be frozen solid in 45 seconds, vegetables in 50 to 55 seconds, fish in 60 seconds and meat in 80 seconds. These are the maximum times necessary to preserve the food values."

Some of the experiments which have been carried out successfully are: eggs have been frozen and kept for 18 months. Tomatoes and bananas have been frozen successfully and kept for nine months. Green tomatoes have been put in cold storage for seven months, ripened after being taken out and thawed. The cost is ' ridiculously low ', working out at a penny per year for every pound of food frosted and kept in cold storage.

# New Books and Reviews

## RACIAL ELEMENTS IN THE POPULATION

By B. S. Guha (Oxford Pamphlet on Indian Affairs, No. 22, Oxford University Press, 1944, pp. 32, As. 6)

THIS pamphlet is a timely publication more in view of the wrangling going on in Indian political life over the questions of race, religion and culture as exemplified in the political demands for various *stans*. All that clamour really misses the scientific point of view and a rational solution.

The author revises here within a short compass the main conclusions of the first Ethnographical Survey of India by Sir Herbert Risley in 1891 with up-to-date information on the subject. And not only does he stress the fundamental unity of man but shows throughout this learned treatise how man has developed into an immense variety of types resulting from what Mendel discovered as 'chromosomes', passed on from generation to generation as the biological 'trust-fund', influenced though by still more minute entities called 'genes', which together controlled heredity to a great extent. Subjected to altered environments and climatic conditions, new mutations naturally arose separating one group from another; the differences such as pigmentation, shape of the hair, nose, face, head, formation of the eye, etc. being perpetuated by selection and heredity.

Racial types in India come under almost all known types of men, of whom the author has given a fine pictorial illustration. He traces the invasion or infiltration and the ultimate absorption and localization of different racial types in different parts of India, although they seem to have merged more or less completely but thanks to the warring creeds and the caste system many of the races still retain some of their distinctive features. All the same, the various races have made their individual contributions to the development of India's special culture, religion, and economic life.

A more complete fusion of the races, however, was retarded by long distances as well as differences in language, climate and custom over this vast sub-continent though welded politically by the British.

The author is in favour of extending special protection to the aboriginal tribes, as against the disintegrating influences of civilization, since they are not fit to be associated with the general population. But with regard to the rest, he is very much apprehensive of the fertility of the 'poorer, less physically fit and less forward looking' primitive strains swamping the more progressive sections, possessing a higher 'genes' and a higher sense of responsibility—a phenomenon by no means peculiar to India—since this is a world problem.

With a view to evolve a higher race of the mentally and physically fit so as to keep pace with advancing civilization elsewhere, he favours the replacement of the caste selection, which has outgrown its purpose, by biological selection, and also advocates sweeping social reforms such as the establishment of birth control clinics for the diminution of the heavily multiplying poor and the unfit.

The author further wants to prevent the weightage of population on the wrong side by adopting measures, apart from treatment and aftercare, to eliminate or control the undesirable 'genes' responsible for their propagation by modern scientific and humane methods of sterilizing the habitual criminals, deaf-mutes and the mentally deficient, in a word by weeding out the unfit from the reproductive zone. What has been so highly feasible in the domain of plants, cattle and other livestock is unfortunately not easily or ordinarily applicable to men, yet progressive evolution is often jeopardized by irrational sentiments and age-long prejudices. But India must continue to pay for her neglect socially as well as economically till her scientists and social reformers succeed in carrying out healthy reforms. It probably shows that in order to be effective, there must also be a social or eugenic side of man's planning his number and quality attached to any economic planning, that may be and much more so in a densely populated country like India where famines and pestilences constantly recur, providing no less intriguing an enigma to her statesmen, scientists and economists as to how the fertility of industry and agriculture could be made to outpace the fertility of men.

—H.K.S.

## ANNUAL REVIEW OF BIO-CHEMISTRY AND ALLIED RESEARCH IN INDIA—VOL. XIII FOR 1942

(Society of Biological Chemists, India, Bangalore, Rs. 3 or 6*s*.)

WHILE this review contains a faithful record of the activities of Indian workers and as such, much valuable information can be obtained from it, its utility could be enhanced further by the reviewers making their reviews more complete by consulting the reports of the various provincial Agricultural Departments and University magazines as well as the reports of the irrigation research laboratories and those of the private research institutions. Work published in *Indian Journal of Pharmacy* is not reviewed under either Pharmacy or Chemistry of plant products; work published in *Journal of Malarial Institute of India* is not reviewed in human pathology under malaria; and those in *Madras Agricultural Journal, Poona Agricultural College Magazine* are not referred in soil and fertilizers; to mention a few instances of obvious omissions. The contributions on the geological evolution of Gujerat and study of the dietary and nutritional status, published in the *Journal of the Gujerat Research Society* missed the attention of the reviewers. Further in some cases investigations on the same subject are reviewed by several reviewers under different heads while some investigations like those on fermentation are not reviewed at all in any of the branches. The work of nitrogen fixation by algae, review on nitrogen fixation, work on haemopoietic systems, uropoietic systems and the investigations on the relations between interval of cutting and yield and chemical composition of perennial grasses are reviewed in more than one place. A slight change in the divisions to be reviewed and a little editorial touch may eliminate these defects. It is fervently hoped that the reviews may be published at least within six months of the close of the year under review so as to make it more useful to workers in the different branches of Biochemistry and allied subjects.—S.V.D.

### SACKED WOOL

Wool should be packed in clean bags or sacks and marketed as soon as possible after shearing. If the sacked wool must be kept on the farm for a few weeks before being shipped to a wool warehouse, it should be stored in a dry place and in no case should the sacks be piled on the ground because wool absorbs moisture like a sponge.

# From All Quarters

## FIGHTER ON THE FOOD FRONT

AS a graduate who has gone back to the land even as early as 1935, I have tried my level best to do my duty in trying to grow more food myself and asking others to do it.

My village possesses purely wet and purely dry lands. So paddy is the only food crop that could be cultivated with profit in wet lands. The dry lands usually were under groundnut and used to be kept as fallow till the next crop of groundnut. As soon as the campaign was started, I realized that about 600 acres of dry lands are unnecessarily kept idle from November to July. Some used to sow horsegram after groundnut. On my advice the ryots began with *cumbu* (small size) and *ragi*. These two were purely under rainfed conditions. They used to yield about 400 lb. of grain per acre. So for about 600 acres, the yield is about 100 tons. *Ragi* also gives about the same yield. So from 600 acres of dry lands lying as waste I was able to induce the ryots to produce about 100 tons of food crops.

There used to be a stray practice of sowing *cumbu* (big size) in April–May, as soon as summer showers are received, in the dry lands. This used to be harvested in August. Immediately after the harvest groundnut will be dibbled. The sowing of *cumbu* before groundnut used to depress the yield of groundnut. The ryots were made to understand the necessity of growing more food crops and they rightly understood that the decrease in the yield of groundnut is well compensated by the price they get for *cumbu*. This year about 100 acres were brought under this item.

Now, coming to the cultivation in wet lands, the usual practice is to bring the fields under paddy. The tract is such that it is not suitable for any other garden crop except perhaps sugarcane. When I went back to the village in 1935-36, I sought the help of the Department in all matters pertaining to agriculture. Under the guidance of Sri M. A. Balakrishna Ayyar, who is now District Agricultural Officer, Vellore, I was able to show that 'better strain means better yields'. Iron ploughs both for dry and wet cultivations were new to the villagers. The ryots were under the apprehension that iron ploughs cannot be drawn by a pair of ordinary bullocks. To be plain they were not convinced even after a demonstration. It was only after I began to plough my fields with iron ploughs with small pairs that the ryots were convinced.

So much for cultivation. Then the question of manuring comes. Hitherto the villagers used to gather the farm waste and throw it on the level grounds. Now they have learnt with advantage the necessity of composting every available waste in pits. Even in the sheds the ryots adopt dry earth system and increase the cartloads per pair. But now in my village there is not a single ryot who has not composted his manure in pits.

Coming to the last and most important item, viz. good strains, the spread has been very rapid during the last few years; only short duration varieties are suitable. Of these, G.E.B.24, which maintains a high reputation throughout the province (Madras), was in vogue in the village also but the strain was of doubtful parentage. I brought the strains from the Department which gave definitely about 10 per cent increase over the locals. The increase in the area of G.E.B.24 is astounding. I used to give the seed in exchange for their locals. In this way, the area under G.E.B.24 which was about 60 acres in 1938 has risen to about 150 acres in 1942. The demand as such for pure strains is increasing every year. The usual yield for the local is about 2,500 lb. per acre. By the advent of the departmental strain the yield has been increased by about 10 per cent. With good manuring, I was able to get 4,000 lb. under well-irrigated areas. The total tonnage for the village under G.E.B.24 may be taken at 200 tons. By the advent of new strains the increase may be taken to be about 20 tons even under a moderate calculation. For the late sowing, Co.2 has been found more suitable than the local *chinna samba*. The increased yield in this is even greater than in the case of G.E.B.24. This Co.2 has completely replaced *chinna samba*. The acreage under this may be estimated at about 100 acres. The average yield in this is roughly about 2,500 lb. The increase in yield of Co.2 over the local *chinna samba* is about 20 per cent and this comes to about 25

tons of more grain for the village.

Usually G.E.B.24 and *chinna samba* used to be sown in fields under wells. About 100 acres are commanded by wells. Usually after a *Swarnavari* sown in May–June and harvested in September–October the ryot used *chinna samba*. Now Co.2 has completely replaced it.

On the whole, my village which is a small one comprising about 300 acres of wet lands produces about 300 tons of paddy in *samba* and about 150 tons of paddy in May and December–January seasons. The acreage under wells is increasing every year after the installation of electric pumps for baling out water which means production of more food crops. Out of a total of 300 acres of wet for the village, practically 450 acres are cropped both in the first and second crop seasons. The new strains have also spread to the neighbouring villages.

So there has been an increase of 45 tons of paddy and 100 tons of millet from my village as a result of this grow more food drive. But this practice could not be followed throughout the district since there was absence of monsoon rains in time and also there was no proper guide in other parts of the district.

I know of educated friends who think it beneath their dignity to take to farming. To them I would say that there is no loss of respect by becoming a farmer.—SRI S. V. KRISHNAMACHARI, M.A., *Sorayur Village, Wallajah Taluka, North Arcot district.*

## THEY DID IT

UNDER encouragement from Khan Saheb Abdul Salam Chaudhury of Batarasi in the Karimganj Sub-division, Sylhet district, four cultivators, namely Shekh Irman (Akbarpur village), Arab Ali, Kurman Ali (Dharakona village), and Hajir Pattadar (Kujub village) with the advice of Mr F. S. Dutta, Botanical Assistant, Government Rice Experimental Station, Karimganj, carried out in 1943 a minor irrigation project, designed to increase rice production, entirely by voluntary labour of the local cultivators.

When the Lungai river used to be in spate during the rainy season in past years, its water used to find an outlet through a small canal (which normally acted as a feeder to the river) and caused much damage to an area of 2,000 acres under rice. The bund, which has been put across the canal has saved the rice crop of this area. The value of the increased outturn of rice may be estimated at Rs. 600,000. This is an instance of what can be achieved by the right application of initiative and imagination by cultivators themselves.

## NEW SOURCE OF VEGETABLE RUBBER

A GARDEN plant imported into India many years ago for its flowers is considered one of the most promising plants for additional war-time supplies of vegetable rubber. For over a year the Forest Research Institute, Dehra Dun, has been experimenting on it and the experience gained has now been published in a leaflet.

The plant (*Cryptostegia grandiflora*) is indigenous to Madagascar and probably to Africa. The leaflet gives some hints on the choice of plantation site, seed collection and the method of regeneration. It also explains how to protect the plantation from insects and weeds. It is estimated that the cost of plantation of about 5,000 acres will be about Rs. 200 per acre and of this about Rs. 100 will represent expenditure on tools, equipment, buildings and capital assets.

# INDIAN FARMING

ISSUED BY
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# INDIAN FARMING

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Vol. V SEPTEMBER 1944 No. 9

## CATTLE IMPROVEMENT SCHEMES

ELSEWHERE in this issue are reproduced the recommendations of the Special Committee appointed by the Imperial Council of Agricultural Research for formulating a common plan and programme of work for the village Milk Recording Schemes of the Council. The importance of recording and the vital role it has played in the development of cattle all over the world have been stressed in these columns from time to time, but the matter has hitherto been dealt with only in general terms. The recommendations of the Committee bring out the full implications of milk recording and constitute a concrete scheme giving precise details for starting and operating such schemes. These recommendations are of far reaching importance in the development of Indian cattle and deserve careful attention.

The systematic recording of breeding and milk production is of comparatively recent origin. The practice of recording probably arose out of the difficulty experienced by the breeders in remembering the various details connected with breeding and milk production. But when once the written record appeared it began to be studied by students of science, and the studies yielded information of inestimable value, particularly in regard to the inheritance of milk production. The knowledge thus unfolded, coupled with an understanding of the principles of heredity, provided a rational basis for the selection of breeding stock, which was till then in the realm of guess work, instinct or intuition. As a result, the pace of cattle improvement was considerably accelerated and recording grew in popularity. From the data published by the International Institute of Agriculture it would, indeed, appear that cattle in those countries where the industry is most advanced have the largest proportion of recorded cattle. Of all important cattle countries India has the smallest proportion of recorded animals. A much wider extension of recording activities is evidently called for.

This plea for the extension of recording should not be understood to mean that milk recording by itself will improve cattle. Improvement can result only if the recording is complete and comprehensive and if the various operations connected with breeding and milk production are guided by the knowledge obtained by a careful study and interpretation of the recorded data. The term ' milk recording ' in its modern comprehensive sense means not only the recording of milk, but the recording of everything that affects milk production. Thus it is essential to record which bull served which cow and when, what progeny resulted from the service and what the production of the progeny is *vis-a-vis* its dam. The term production itself is a vague term, and to make it definite it is necessary to record the conditions under which the production was obtained. These conditions are what and how much the animal ate, whether she was sick and if so for how long, her age at the time of production, and so on. Again as it is of the greatest importance that each animal and its progeny should be recognizable under any condition by any one systematic marking is necessary ; that can usually best be done by tattooing or branding. Thus milk recording means recording of full details regarding the identification of each animal, its date of birth, parentage, breeding, milk production, feeding, disease, etc., and similar details regarding progeny in each succeeding generation. It should be a continuous process. Then only can the productivity of animals be studied from generation to generation with a view to select for further breeding work those

animals that are known to be able to transmit the desired character to their offspring. Unless recording is designed with this end in view and the recorded data are properly studied and utilized for the selection of breeding stock milk recording will have but a limited use as a means of cattle improvement.

Work of this kind is not done in India on any appreciable scale. Recording is at present confined to Government farms and to a very small number of privately owned farms. These together constitute only a microscopically small proportion of the country's vast cattle population, and the output of bulls from these farms is not even a hundredth of the requirements. There is a limit to the increase in the number of farms, and the Imperial Council of Agricultural Research realized almost from its inception that the large number of bulls of the desired type and quality required by the country can be produced only if controlled breeding work is extended to selected breeding tracts and conducted there on a large scale with necessary arrangements for recording.

A few village schemes were accordingly introduced in different parts of India with funds provided jointly by the Council and the province concerned. Under each scheme a Recorder was appointed for recording the breeding, feeding and milk production of selected cows in specified tracts. The schemes have been going on for two to three years now. It is futile to look for definite results within such a short period seeing that cattle are slow breeding animals, that the experiment is quite novel to India and that the breeders that have to be dealt with are mostly illiterate and small, owning only about two animals each as against an average of 27 or 28 animals owned by a farmer in a country like England. The schemes were, however, only of an exploratory nature and have yielded experience of very great value showing how such schemes should be introduced and worked. The Imperial Council of Agricultural Research at its meeting held in February 1944 appointed a Committee to examine the working of these schemes and to lay down a common plan and programme for the future. The recommendations already referred to are the results of the deliberations of this Committee.

These recommendations are self-explanatory, and are designed to provide the full information necessary for guiding cattle improvement work. As will be seen, strict breeding control and the linking up of breeding with production constitute the essence of the scheme. The area selected for the work should be small and compact and all the cows in the area will come under breeding control. No bulls other than those selected and approved by the Department will be permitted in the area. The services of bulls should be recorded, contact should be kept with the progeny resulting from the service and eventually they too should be milk recorded. All the animals should as far as practicable be protected against disease. Feeding should be recorded and feed depots established where feasible. The work should in short be conducted as if the selected centre were a stud breeding farm.

It will thus be seen that a real Milk Recording Scheme is a complete scheme of cattle improvement. 'Cattle Improvement Scheme' would therefore appear to be a more appropriate and expressive title than 'Milk Recording Scheme' which is generally understood in a narrow sense and taken to mean a scheme for the recording of milk.

The importance of these schemes and the potentialities they possess for cattle improvement can hardly be exaggerated. If properly worked out as envisaged by the Committee, these centres will develop into radiating focii of superior germ plasm. A multiplicity of such centres is required for producing the large number of breeding bulls required by India.

# Original Articles

## FISHING INDUSTRY IN INDIA

By

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ALTHOUGH fisheries constitute the third important industry, at present they occupy but a minor place in the economic organization of the country. Fish are caught when available, from every piece of water. The chief sources of supply are the coastal margins of the sea, river estuaries and back-waters for salt-water fish, and rivers, canals, tanks, inundated tracts, etc. for freshwater fish.

### *Definition*

Broadly speaking, the word 'fish' includes not only the members of the finny tribes but also *crustaceans* (prawns, lobsters and crabs) and *molluscs*, (oysters and clams, and pearl oysters, chanks and other varieties of economic importance). Though most of the true fishes are edible, only about 50 are commercially important. Pomfrets, seer, perches, certain types of jew fishes and mullets among sea fishes and *rohu*, *catla* and several varieties of cat-fishes caught from freshwater, are popular with the consumers. Among marine fishes, sardines, mackerels, sharks and cat-fishes, although not so well-known as table fish, are commercially important.

The sea fishermen catch fish very near the shore and do not go beyond a distance of 5 to 7 miles. The crafts (canoes and *catamarans*) are small and undecked. They usually start in the morning and return in the evening. All large rivers, tanks, back-waters and estuarine regions of rivers are heavily fished. As regards nets and other fishing implements, these are such as would help the capture of particular fishes. Bag nets, drift nets, inshore drag nets and long lines are used in marine fishing. For fishing in rivers, back-waters, tanks, etc., spears, traps, baited springs, harpoons and other similar ingenious devices are employed. Cast nets are very commonly used while fishing in shallow waters. Power fishing of Indian seas has only been tried on an experimental basis on a few occasions. Further experiments to determine the best types of fishing vessel and gear suited to Indian conditions, *i.e.* a power boat which will catch marketable fish in commercial quantities and at competitive rates, have to be conducted. In view of the magnitude of the problem, Government will have to carry out these experiments and thus lead the way.

### *Consumption*

In the absence of reliable statistics it has been possible only to estimate the landings of fish in India. Inclusive of fish caught in estuaries and back-waters the total annual production of marine fish is estimated at 116·7[1] lakh md. valued at Rs. 302·7 lakhs. It has been possible to estimate only the marketable surplus of freshwater fish which amounts to 62·6 lakh md. valued at Rs. 742·3 lakhs per year. Thus the average cost of sea fish is only Rs. 2-10 per md. against Rs. 11-14 per md. for freshwater fish.

Madras province accounts for nearly 40 per cent and Travancore 22 per cent of the total sea fish landed. In the former, the area of concentrated production is the West Coast littoral comprising South Canara and Malabar districts. The south-west coast of India consisting of the maritime districts of the Madras province, Cochin and Travancore States,

[1] Hilsa, although a marine fish is caught chiefly in freshwater and is marketed along with other freshwater fish. If the estimated annual catch of hilsa, *viz.* 5·5 lakh md. is included under freshwater fish, the marketable surplus of freshwater fish becomes 68·1 lakh md. Correspondingly the production of marine fish would be reduced from 116·7 to 111·2 lakh md.

with but a coastline of about 430 miles, accounts for over 52 per cent of the total marine fish landed in India. The share of Bengal is nearly 15 per cent (the majority of the catch being estuarine), that of Bombay 12 per cent, while those of Orissa and Sind are 2·6 and 1·7 per cent respectively. Bengal, however, leads as regards supplies of freshwater fish, her share being nearly 50 per cent of the total marketable surplus of freshwater fish in India. In Bihar and Assam also freshwater fisheries are important, the shares of these provinces being 15·3 and 11·5 per cent respectively of the marketable surplus of freshwater fish in India.

Fishing goes on in the sea all through the year except when the weather is squally, which is so when the monsoon winds are strong. Rivers are generally not fished during the rains except in Bengal. Tank fishing is prosecuted with vigour when the level of water in the tanks is low, *i.e.*, during early summer. In general, fish production is concentrated during the period September to February and is lowest between May and July.

### *No imports of raw fish*

There is practically no import of raw fish into India. Considerable quantities of preserved fish, *e.g.*, dried fish (salted or unsalted), wet-salted fish and canned fish and fish products such as cod liver oil and fish manure of total annual average value of Rs. 16 lakhs are imported. Of these products, all except canned fish and cod liver oil are imported from adjacent countries like Arabia, Maskat territory, etc. India had an export trade in preserved fish with Ceylon, Burma, Strait Settlements and Hong Kong, valued at over Rs. 75 lakhs per year.

The average *per capita* consumption of fish in India works out at 3·4 lb. per annum, though actual consumption in different tracts varies widely. The highest consumption is observed in maritime tracts on the west coast. Fish is a very popular item in the diet of a Bengali and the *per capita* consumption in the province is 6·73 lb. Among completely inland areas Assam leads with a *per capita* consumption of 3·64 lb. followed by Bihar with 2·00 lb. The consumption in the Punjab is the lowest being only 0·09 lb. per annum.

Regarding utilization, one half of the total production is consumed as fresh fish ; one-fifth is cured by salting ; another one-fifth is simply sun-dried while approximately 10 per cent is converted into fish fertilizers.

The Government of India allow salt free of duty for curing fish under certain conditions. This concession is not operated in all fishing areas. Fish curing yards—enclosures where salting of fish is carried on—are found in maritime areas, the largest number is in the Madras province where over 65 per cent of the production of salted fish in the country is concentrated. Government fish curing yards do not exist in Sind and Bengal. In Bengal, Travancore and Bombay sun-drying is the popular method of preserving fish. A considerable quantity of small thin varieties is also preserved by simple sun-drying in the Madras province. As yet the fish canning industry has not made any headway in India.

### *Reforms needed urgently*

For the proper development of the fishing industry in this country certain urgent reforms in the methods of assembling and distribution of fish are necessary. In the first place, collection of fish from fishing boats and their transport in fresh condition, preferably packed with ice, to the consuming centres should be expedited. More attention should be paid to cleanliness in the handling of both fresh and cured fish. The chief economic need of the industry is to secure a more uniform or well-distributed supply during the different periods of the year. It cannot be secured by a regulation of the catch ; it has therefore to be found in the process of marketing. At present an immediate market is imperative with resultant gluts and shortages. Storage of fresh fish is a difficult job and available facilities are practically nil. Storage of frozen fish to even out supplies during the off-season is a process well worth investigation. Another solution seems to be in a more widespread use of salted fish. For this the products have to be improved considerably.

Even now there is a fair demand for preserved fish in the interior of the country. With wise propaganda it would not be difficult to popularize the consumption of preserved fish in areas where this type of food is still unfamiliar, if fisheries departments in provinces and States would help to produce preserved fish in a more attractive form. It may be stated that a great deal of research for preserving fish under tropical conditions is needed before suitable methods can be evolved for adoption by the provinces.

'Fisheries' is a provincial subject in India. Although skeleton fisheries departments have

been in existence for several years in most of the provinces and Indian States, it has to be stated that an institution fully organized and equipped for fisheries research does not exist in this country.

### *Research stations wanted*

The economic importance of Indian fisheries is considerable and the benefit of an increased supply of fish to the health of the nation can hardly be exaggerated. A great deal of pure and applied fisheries research has to be taken in hand immediately to increase the quantum of fish supplies. To mention only a few of the problems: Research is required into the systematic classification of Indian fishes with the study of their life-histories. Secondly, investigation into fishing methods is necessary since many waters are fished by men using primitive crafts and implements which prevent their making full use of the fish supplies. Thirdly, methods of preserving and processing fish need investigation as well as its marketing and transport facilities. For all this a chain of marine fisheries research stations are required and the establishment of a central research station for freshwater fisheries. A well co-ordinated and comprehensive programme of development can be pushed through only if Government takes initiative in the matter.

## ARMY GROWS MORE FOOD

The Eastern Command is today producing 30 tons of vegetables a day and hopes to increase the output by another 40 tons. Potatoes and onions are being grown over 12,000 acres of land, which will in time produce 150 tons daily.

The daily output of the military dairies comes to 12,000 lb. of milk. Poultry farming, pig breeding, and pisciculture also form a part of these activities.—*Indian News and Notes.*

# SUGARCANE IN ASSAM

By

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and

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SUGARCANE occupies an important place in Assam agriculture and is one of the crops being systematically studied for a long time, yielding results of high practical importance. Improvements in general sugarcane farming in the province have not been in keeping with the progress of research work, as the results of research work have not reached the common cane growers as rapidly as they should. Some improvement, however, has undoubtedly been made, mainly due to the adoption of improved varieties recommended and distributed from the Jorhat Experimental Farm. The annual total average area under cane in the province fluctuates round about 40,000 acres, cane growers being mostly poor cultivators who utilize their crop in *gur* production.

## Climatic advantages

Assam climate is almost entirely sub-tropical and is very much favourable to sugarcane farming. The chief advantages are : (1) absence of dry hot weather, (2) favourable rainfall and humidity and (3) copious rainfall between March and May at a time when rainfall over most parts of Upper India is at its minimum, necessitating artificial irrigation. The annual rainfall in Assam is suitable for sugarcane cultivation without irrigation.

*Sugarcane areas of the Province*: The province falls into three natural divisions, viz. (1) the Surma Valley, (2) the Assam Valley and (3) the intervening hills. Sugarcane areas lie principally in the two valleys, the important sugarcane growing districts being Cachar and Sylhet in the Surma Valley, and Sibsagar and Kamrup in the Assam Valley. The soils of most of these areas are alluvial and are very suitable for sugarcane farming. Some virgin soils and some areas enriched with silt during rains have been found to be very rich and have yielded good crops even upto fourth or fifth ratoons without any manurial application. The majority of the soils of sugarcane areas, however, require adequate nitrogenous manuring to produce a good crop of cane. Experiments at the Jorhat Farm, where the soil is a reddish sandy loam and represents an average type of the old alluvial soil of Upper Assam, have shown that canes should be manured with 120 lb. *N* as cowdung (300 md.) plus 50 lb. *N* as mustard cake (1,000 lb.) per acre for getting a high yield of crop.

## Varieties under general cultivation

Assam has been growing several varieties, viz. *teli* and *bogapura*, considered as local canes, for a considerable time. Varieties recommended from the Jorhat Farm have been definitely found to be superior to local canes. Therefore the area under the latter is gradually decreasing owing to the replacement of these varieties by improved varieties recommended and distributed from the Jorhat Farm. A thin cane called *khagri* is popular with certain cane growers of the Surma Valley, who have been growing it for a long time.

Exotic canes from Java, Barbados, Demarara and Mauritius have been under cultivation for a fairly long time. The striped Mauritius was once very popular in the Brahmaputra Valley ; but because of its liability to lodging and insect attacks, it has lost its ground and is now grown only to a limited extent. D.74, B.6308 and B.376 were once favourites. The area under them has now decreased considerably. POJ.2714 covers a considerable area and is very popular in some areas. POJ.2878 is grown in some areas but it is much less popular than POJ.2714.

Some of the Coimbatore canes are proving very popular and are replacing *magh*, *teli*, etc. and exotic canes like D.74, B.6308, B.376 and S.M. These promising Coimbatore canes include Co.213, Co.313, Co.290, Co.361, Co.419, Co.421, Co.408, Co. 413 and Co.J.I.

## Research work at Jorhat

Work on sugarcane to meet the requirements of the province has been concentrated

at the Jorhat Farm since its establishment in 1906. Previous to the starting of the Sugarcane Research Scheme in 1933, varietal tests were carried out at the Jorhat Farm directly under the Department of Agriculture, Assam. Exotic varieties from Java, Barbados, Demarara, Mauritius and subsequently canes from Coimbatore were tested to pick out suitable varieties for Assam. Varieties recommended as a result of these tests include S.M., B.147, B.376, J.33a, B.3412, D.74, POJ.1507, POJ.1714, B.6308, H.109, Co.210, Co.213, Co.290, Co.313, POJ.2878 and Co.361. These when added to varieties recommended under the scheme make up a total of 23 varieties in the departmental list of recommended canes.

The Jorhat Experimental Farm is at present the only farm in the province engaged in sugarcane research work which has considerably increased due to the addition of the research work under the Jorhat Sugarcane Research Scheme financed partly by the Imperial Council of Agricultural Research since 1933. The work of the scheme falls under three main headings, viz. (i) varietal tests, (ii) manurial tests and (iii) cultural tests, the object being to find out suitable varieties for Assam and to work out effective methods of manuring, cultivation and management of canes. In carrying out these tests, the chief requirements of the province (i.e. *gur* production) is kept in view and the main attention is directed towards obtaining high yields combined with juice of high sucrose content and purity (at the time of maturity), and other desirable characters.

Cane varieties with high tonnage yields and juice of high sucrose content and purity (at maturity) usually give high yields of *gur* of good quality. Varietal tests form the most important part of the scheme and consist of exhaustive tests of new promising canes received from Coimbatore, extending over a number of years. Usually new varieties of canes from Coimbatore are tested in the nursery in the first year, after which they are tested in the observation plots where studies on germination, growth and ripening are made.

Varieties found promising are grouped into 'early', 'medium' and 'late' canes according to their ripening periods and are then tested in the semi-final and final varietal tests with up-to-date designs and proper replication. 'Early' canes of the Jorhat Farm are those which ripen in the early part of January or earlier 'medium' canes are those ripening in early February and the 'late cane' ripens in early March ; canes being planted in the period January–March of the previous year. Only the varieties which have proved to be high yielding with high quality of juice and other desirable characters as plant canes in the final varietal trials at least for three years are recommended and distributed to cane growers for general cultivation.

As ratooning is a common practice in Assam, the semi-final and the final varietal trials are carried out in each case both with plant and first ratoon canes. The object of experimenting with ratoon canes is to determine the ratooning capacity of different varieties.

Varieties recommended and distributed amongst the growers in Assam after exhaustive tests under the Jorhat Sugarcane Research Scheme during 1933-1943, include Co.419, Co.421, Co.408, Co.355, Co.356, Co.413 and Co.J.I. Co.419 (late ripener) and Co.421 (medium ripener) are at present the leading high yielders of the Farm. The former (as plant cane) recorded an yield of 53·96 tons of stripped canes per acre in 1935-36, this being the highest yield recorded so far under the standard system of cultivation and manuring at the Jorhat Farm.

Closely following this yield, Co.421 (as plant cane) gave an yield of 50·69 tons striped canes per acre in 1936-37. These two varieties are becoming increasingly popular with the cane growers of the province. Co.355 (medium ripener) and Co.356 (medium ripener) are the only two *jowar* crosses which have proved successful at the farm. They have already been recommended outside where their performance is being watched with interest.

### The future

As has been stated before, cane growers of the province have not yet been able to derive full benefit from the results of research achieved at the Jorhat Farm. Improved varieties recommended and distributed from the Jorhat Farm hardly cover more than 35 per cent of the total area under canes, and cane growers of the province, in spite of favourable soil and climatic conditions, hardly get more than 10 to 12 tons of canes per acre against 25 to 30 tons per acre obtained at the Jorhat Farm with improved varieties under improved methods of cultivation and manuring.

Assam is not self-sufficient in *gur* and hardly produces any sugar. The normal annual

imports of these commodities are valued at about Rs. 50 lakhs. Apparently there is large scope for improvement and expansion of sugar-cane farming in Assam and much work lies ahead to bridge the gap between the research station and the field and to increase the area under cane cultivation. This has a very important bearing on the economic future of the province.

## SOIL FOR SELECTING A FARM

THE selection of the right kind of soil is important in choosing a farm and the success or failure of a farm enterprise often depends on this, says P. C. Stobbe, Central Experimental Farm, Ottawa.

Soils vary greatly in their appearance, in their fertility and in their suitability for different crops. The type of farming which can be successfully practised depends to a large extent on the nature of the soil. For this reason it is often advisable to decide first on the type of farming which is to be followed and then select a farm with soil suitable for the purpose. The type of farming which is desired varies with the aptitude and preferences of the individual. It may to some extent be limited by climatic conditions and may have an important bearing on the general location in respect to distance from market.

Some soils are suited for a wide variety of crops, while others are more specific in their demands and are adapted for some specialized types of farming. Thus a good market garden soil should be high in organic matter, easily worked, and well supplied with plant nutrients; the requirements of a good orchard soil are good drainage, ease of root penetration, and absence of excessive amounts of lime. The best potato soils are usually moderately acid, well drained and not too heavy in texture, while the better grain and hay soils are usually medium to heavy in texture and neutral or only slightly acid in reaction. First class flue-cured tobacco soils usually consist of deep, fine sands which are of little value for most other crops. Comparatively cheap farms with a large proportion of pasture and hay land are usually well suited for beef raising, while dairy farms are usually located on more productive and more expensive land.

There are a number of soil characteristics which have a close bearing on the suitability and productivity of the soil and they can be observed during the examination of the surface and subsoil in the field. Some of the more important points to observe are the texture or heaviness, the depth, the degree of friability, the structure, the drainage, the stoniness and the colour and organic matter present. Other factors such as the degree of slope, the extent of erosion and the degree of leaching can also be observed easily in the field. The condition of the crops growing on the land give a good indication of the immediate fertility of the soil but it is important to know under what management practices the given crop has been produced.—*Department of Agriculture, Canada.*

# CONTROL OF MANGO HOPPERS IN BOMBAY PROVINCE

By

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and

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THE jassid hopper (*Idiocerus* spp.) is a serious pest of mango blossoms in the coastal areas of Bombay province. Due to the regularly recurring ravages of this pest there is every year much reduction of fruit and in many orchards the mango crops are often a total loss.

## Seasonal history

There are three species of mango hoppers, namely, *Idiocerus atkinsoni* Léth., *I. niveosparsus* Léth., and *I. clypealis* Léth. The first two species of hoppers are easily distinguished from the third by their large size, and, between themselves, these can be recognized by the markings on their bodies. The adults of *I. atkinsoni* are mostly found on the main trunk and branches of mango trees, whilst those of *I. niveosparsus* and *I. clypealis* are always found on the leaves except in the flowering season when they mostly rest on the flower shoots.

Of the three species of hoppers, *I. clypealis* is the most prolific breeder, and thousands of its young ones can be seen sucking vigorously at mango flowers and buds. It breeds on flowers once in the year, usually in the months of January and February. *I. niveosparsus*, on the other hand, breeds throughout the flowering season, but its nymphs on the flower-heads are always found in small numbers. This hopper also breeds on vegetative shoots in June and October. *I. atkinsoni* is a very shy breeder, and, like *I. niveosparsus*, breeds three times in the year, mostly on vegetative shoots and rarely on blossoms. Detailed observations have shown that, during the flowering season, *I. clypealis* and *I. niveosparsus*, severally and jointly, are more prevalent on the inflorescences than *I. atkinsoni*, even in areas where the latter insect occurs in great abundance during the monsoon and in October. It appears, therefore, that *I. atkinsoni* is not responsible for much damage to blossoms, and that its presence in large numbers in the period preceding flowering of mango trees is no indication of its being a serious pest.

## Distribution and reaction to sulphur

The three species of jassid hoppers are found in mango gardens all over the province, but they vary in their prevalence in different areas. In the Konkan and the Karnatak, the predominant species of hopper is *I. clypealis*, which is also the most destructive. The other two species, *viz.*, *I. niveosparsus* and *I. atkinsoni* are usually found in large numbers in south Gujarat and the Bombay suburban area. Under field conditions these hoppers react differently to the action of sulphur so that, whilst the nymphs of *I. clypealis* are most susceptible to the effect of finely powdered sulphur dust, those of the other two species are rather tolerant. This differential behaviour of mango hoppers to sulphur dust explains the marked success of the sulphur treatment in the Konkan and the Karnatak, where *I. clypealis* is the most prevalent species.

This jassid has also been reported as a serious pest of mango blossoms in South India, Mysore, Bihar, the United Provinces, the Punjab, Burma, and Sind. In South India all the three species are present, but *I. niveosparsus* is the most injurious. In Mysore, *I. clypealis* is found breeding mainly on flower spikes, whilst the other two species breed on young vegetative shoots as well. *I. atkinsoni* and *I. clypealis* are the only two species found in Sind and the Punjab, in which latter province *I. atkinsoni* is more prevalent than the other species. In Burma, *I. atkinsoni* is the only species noted so far.

## Nature of damage

The nymphs of these insects do great damage. They suck sap from mango flowers and buds,

which ultimately dry up and are shed. Oviposition in flower-buds and small fruits arrests their development. The nymphs secrete large quantities of the so-called honey-dew, which covers the flowers and interferes with their fertilization. Later on the sooty mould develops on these sugary secretions and invests the entire surface of leaves and blossoms, the affected trees presenting a characteristic black appearance.

The damage done by the adult hopper is comparatively negligible. It mostly feeds upon vegetative shoots and young leaves and less frequently upon flowers.

## Life-history

Females lay eggs singly in tender tissues of mango plants, usually in the mid-rib of the leaves or in the axis of the flowerheads. Eggs are also laid in the tissues of very young fruits. These are at first translucent and later turn yellowish.

Eggs hatch out in 4 to 6 days. The young nymph is at first white with two small, red eyes, but later turns yellowish. The nymphs cast four moults at intervals of 2 to 4 days and develop the characteristic black and brown markings peculiar to each species. After 10 to 13 days full-grown adults appear. Thus the whole life history from the laying of the eggs to the emergence of the adult hopper is 15 to 19 days, and this holds true for the three species. There is also not much variation in the life cycle of mango hoppers in different periods of the year. In the Punjab, however, the total length of the life cycle varies from 25 to 29 days, the egg period varying from 8 to 10 days and the nymphal phase from 17 to 19 days. The number of moults which the nymphs undergo is five.

After the breeding seasons the adults pass their life resting on the stems (*I. atkinsoni*) and leaves (*I. clypealis* and *I. niveosparsus*) of mango trees, but their numbers continue to decline due to unfavourable weather conditions. The hoppers multiply rapidly when the breeding season starts.

Although the adults are generally found on mango trees, they are sometimes also seen on leaves of various species of citrus and *Calophyllum inophyllum*, but these do not serve as alternate food plants for the insect.

## Sulphur dusting

In the Punjab and in South India, fish-oil rosin soap and crude oil emulsion have been recommended for dealing with mango hoppers, but these sprays have not been found to give effective control of the pest since the sprayed trees are reinfested with the hoppers within two or three days after the treatment. Sulphur dusting, however, produces a more lasting effect, and has been readily adopted by mango growers.

Sulphur dusting has been found to be most effective in controlling mango hoppers in the Konkan where gardens dusted three to four times during the flowering season suffer no appreciable damage from this pest. This treatment, however, has not proved successful in Gujarat, and accordingly trials were undertaken throughout the province in 1938 and continued for four subsequent years. Results of these trials which were done on a large scale, showed that the marked success of sulphur dusting in the Konkan and the Karnatak and its failure in south Gujarat and the Bombay suburban areas, in checking mango hoppers, was mainly due to the relative prevalence of the different species of the hopper in those areas. In the Konkan and the Karnatak where *I. clypealis* is the most important species of mango hoppers, three to four applications of sulphur dust effectively controlled the pest, but in south Gujarat and the Bombay suburban area the problem is one of control of *I. niveosparsus* since *I. atkinsoni* is not found breeding there to any large extent during the flowering season. However, as *I. niveosparsus* is comparatively more resistant to the action of sulphur than *I. clypealis*, the need for repeated dusting of mango trees in South Gujarat with a view to effective control of the pest is obvious.

## Programme of sulphur dusting

As explained above, the number of sulphur dustings required for effective control of mango hoppers varies according to the prevalence of the species of the hopper in different areas. The following schedule of sulphuring is now widely adopted in practice in Bombay province :

(a) *Konkan and Karnatak :* The first application of sulphur should be made when mango trees are in blossoms, and should be followed by two or three dustings at intervals of 10 days. Only flowerheads should be dusted. The quantity of sulphur required to cover flowerheads varies at different flushes, but ordinarily 2 lb. of sulphur should be sufficient for a tree about 25 ft. in height, at each dusting.

PLATE 37

Dusting to save mangoes against hoppers

(b) *South Gujarat and Bombay suburban area:* In these areas also sulphur dusting should begin as soon as the mango trees are in flower, and should be continued at intervals of 10 days. The number of dusting necessary for effective control of the pest, however, varies from eight to ten instead of three to four as in the Konkan. The quantity of sulphur required for a mango tree at each dusting is also more than 2 lb., since mango trees in these areas make much bigger growths.

It should be borne in mind that after an application of dust it will be necessary to resulphur if three to four days of bright sunshine do not intervene before the dust is removed by rain. It is also necessary to repeat the operation as long as new inflorescences are being formed and to renew the coating on older ones as the dust weathers off. The aim of sulphuring should be to cover the exposed surface of the flowerheads but never to make thick deposits of sulphur on the latter.

## Time of dusting

There is an idea among mango growers that sulphur should be applied when the plants are wet with dew. This is, however, contrary to what should be done. When sulphur is applied to a wet surface, the fine particles of the dust falling on a film of moisture covering the inflorescence tend to come together and form patches after the moisture is dried. Sulphur in this condition does not become readily available as an insecticide.

Sulphur should be applied to mango blossoms during the cool part of the day and it will become active when the temperature rises. Sulphuring in high wind results in the waste of material, but a gentle breeze helps the operation. Dry, moderately warm weather and still days are most suitable.

## How to dust

The best method of applying sulphur to mango inflorescence is by means of a duster of fan-blower or crank type. A good duster of this type is Peerless Dust Gun, which is easy to operate, produces a steady flow of dust, and blows out sulphur in a fine, impalpable form to a height of 20 to 30 ft. from the ground.

In the Konkan, mango trees can be thoroughly dusted without much difficulty as these trees are generally 20 to 25 ft. in height, but sometimes a step-ladder is necessary. In south Gujarat and the Bombay suburban area where mango trees usually grow to a height of 35 ft. or more, rubber pipe or tin tube extensions should be used for dusting. Standing on the ground or on a step-ladder, one person cranks the machine whilst the other directs the nozzle borne at the end of a tin tube extension to individual flowerheads as shown in the figure.

## Success of sulphur dusting

One of the causes of failure of the sulphur treatment as a deterrent against mango hoppers is the quality of sulphur used for dusting. The characteristics of a good sulphur dust are its fineness and freedom from admixtures; in fact, the finer a sulphur powder the more effective it is as an insecticide or a fungicide. It is, therefore, strongly recommended that, for obtaining best results in control of the pest, sulphur of 300-mesh fineness i.e., dust which can pass through a sieve having 300 meshes to a linear inch should invariably be used. Some of the brands of finely powdered American sulphur are most suitable for dusting purposes.

Gardens thickly planted and with shade all over harbour very large numbers of the hoppers and are thus more affected. It is essential that gardens should be kept clean of weeds during the flowering season and those closely planted should be thinned out to let in more sunshine. Lack of these conditions in mango gardens has often been the cause of failure of the treatment, especially in the Bombay suburban area where many of the mango plantations are old and not well looked after.

## Cost of dusting

The cost of one cwt. of the best American sulphur of over 300-mesh fineness is Rs. 7-8 according to pre-war rates, and the expenses incurred in dusting a mango tree during the flowering season in different areas are as under :

| | Konkan (4 dustings) Rs. | | | South Gujarat (8 dustings) Rs. | | |
|---|---|---|---|---|---|---|
| Sulphur at the rate of 2 lb. per tree | 0 | 8 | 6 | 1 | 1 | 0 |
| Labour .. .. .. | 0 | 2 | 0 | 0 | 7 | 0 |
| Total .. | 0 | 10 | 6 | 1 | 8 | 0 |

As a result of dusting, the yield of mango fruits is much increased so as to give a net return of Rs. 4 to 5 per tree.

# THE RAMACHANDRA WATER LIFT

By Colonel G. B. Howell
*Military Secretary to H. E. the Governor of Madras*

THIS is an invention of Mr S. Ramachandra Aiyar of Madras, who is a Diplomate of the Madras College of Agriculture, and the mechanism is simple and efficient. It is similar to the ordinary *mhote* (*charsa* or *kavalai*), except that the animal is mounted on a small, low-wheeled platform moving on rails. The combined weight of the platform, bullock and attendant is just sufficient to raise the water from the well to the discharging point, without exertion on the part of the bullock. This lift is suitable for any depth of well, and a ramp with 3 to 1 gradient has been found suitable, economical and satisfactory. The size and volume of the bucket may be from 20 gallons to 35 or even 40 gallons, according to the weight of the animal available. Friction has been reduced to the minimum by the use of ball-bearings for pulleys and the wheels of the trolly moving on rails. There is practically no jerk at the time of discharge, as the trolly is brought to a stand-still gradually. When the upward movement of the bucket is arrested it revolves on its own axis, and discharges the water quickly without much of spilling.

## Mechanism of the lift

A lift of this type has been installed in the Guindy Park, Madras, and this report is based on actual observations made during practical tests.

The lift consists of the following parts:

(1) A trolly with roller bearings for the 4 wheels; the weight of the trolly is about 150 lb; size 4 ft.×3 ft.; size of wheels 6½ in. in diameter excluding flanges.

(2) An iron bucket weighing about 50 lb. with a capacity of about 33 gallons; 20 in. deep and 22 in. in diameter.

There is a projection at the bottom of the bucket to which is attached a rope which goes below the wooden cross beam and on to the upper end of the trolly. This rope is used for tilting and filling the bucket.

(3) A double grooved pulley with two cast-iron stands fitted with roller bearings, mounted on the cross beam at the top of the well. A flexible steel rope, ½ in. in diameter, goes over one of the grooves; one end of the rope is attached to the bucket and the other to the upper end of the trolly. A momentum or control rope in the form of a cross belt passes over the other groove from the upper end of the trolly, over the pulley, across the entire length of the ramp, and then over the pulley at the foot of the ramp and on to the lower end of the trolly.

(4) A single grooved pulley with cast-iron bearings at the foot of the ramp between the rails.

(5) Track of rails, 2½ ft. gauge, 5 ft. longer than the depth of the well as measured from the silt to the point of discharge.

(6) A guide rod ¾ in. in diameter, from the point of discharge to the bottom of the well.

## Method of working

When the lift is not in use, the trolly is derailed at the foot of the ramp and the bucket is at the discharging point on the top. For operating the lift, the following are the details of procedure: (1) The derailed trolly is put in position, and released, and it moves up the ramp automatically by the weight of the empty bucket. This brings the empty bucket down the well and leaves it flat resting on the water. (2) The attendant goes up the ramp, pushes the trolly forward so as to tilt the bucket and then pulls the tilting rope. This fills the bucket, and leaves it just below the water level. (3) Meanwhile, the bullock goes up the ramp between the rails and mounts on the trolly; when the fore-feet are on the trolly, half the bucket is seen above the level of the water, and when the bullock is fully mounted the filled bucket just rests on the water. (4) After seeing that the animal is well settled on the trolly, the attendant mounts the platform on the animal's right, and pulls the momentum rope which sets the trolly moving down. (5) When the trolly reaches the foot of the ramp, the bucket is at the top of the well, and water discharges. Then the bullock dismounts on its left, the attendant then releases the trolly which moves up the ramp automatically for the next filling. (6) The attendant goes up

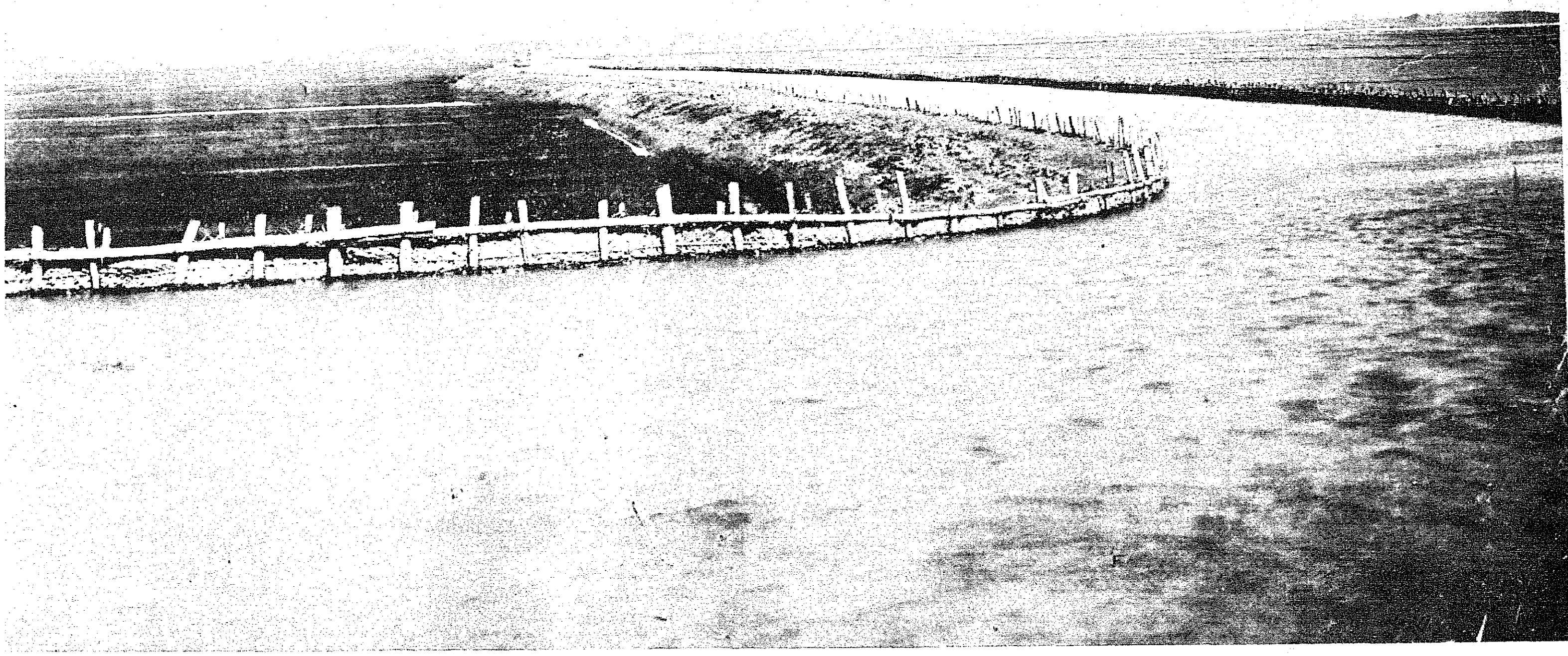
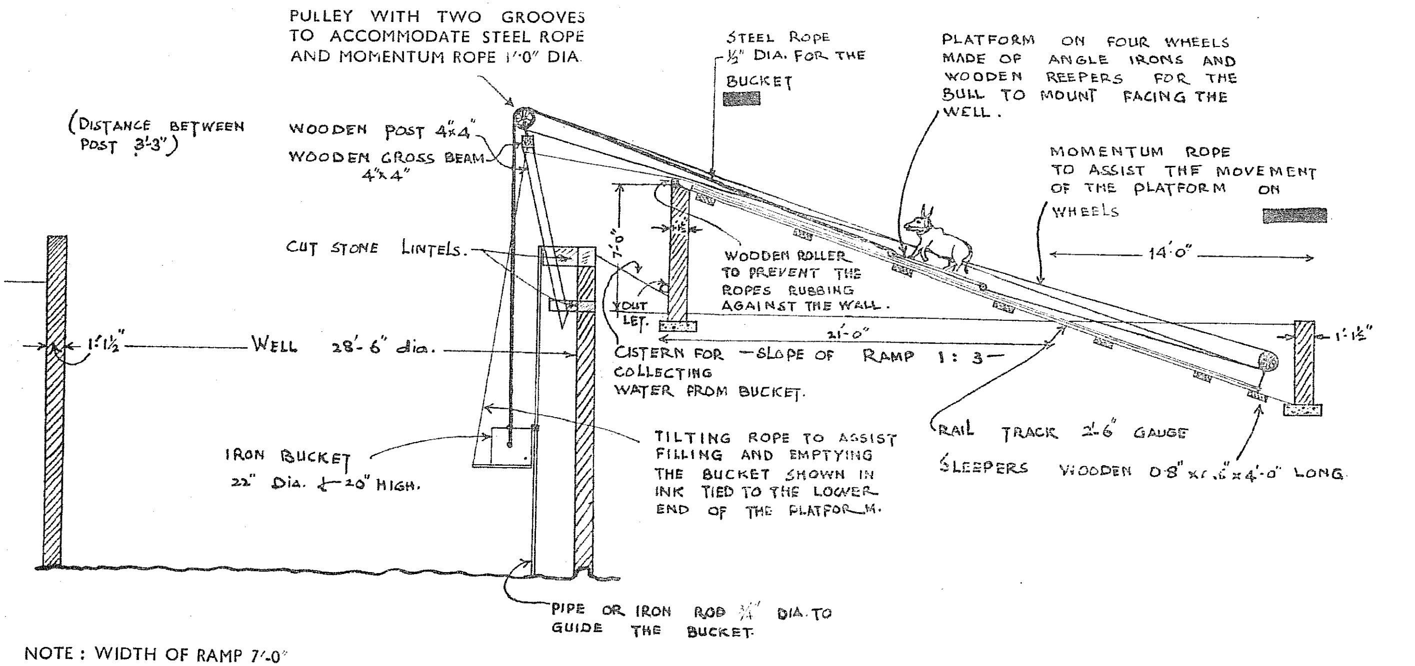


FIG. *Kole* cultivation in Cochin. Fields have been drained and canals are full. Water in the canals is at a much higher level than the fields.




LONGITUDINAL SECTION

—GUINDY PARK—

—RAMA CHANDRA WATER LIFT—

—GOVERNMENT HOUSE GUINDY—

Scale: 1" = 6'-0".

PLATE 38

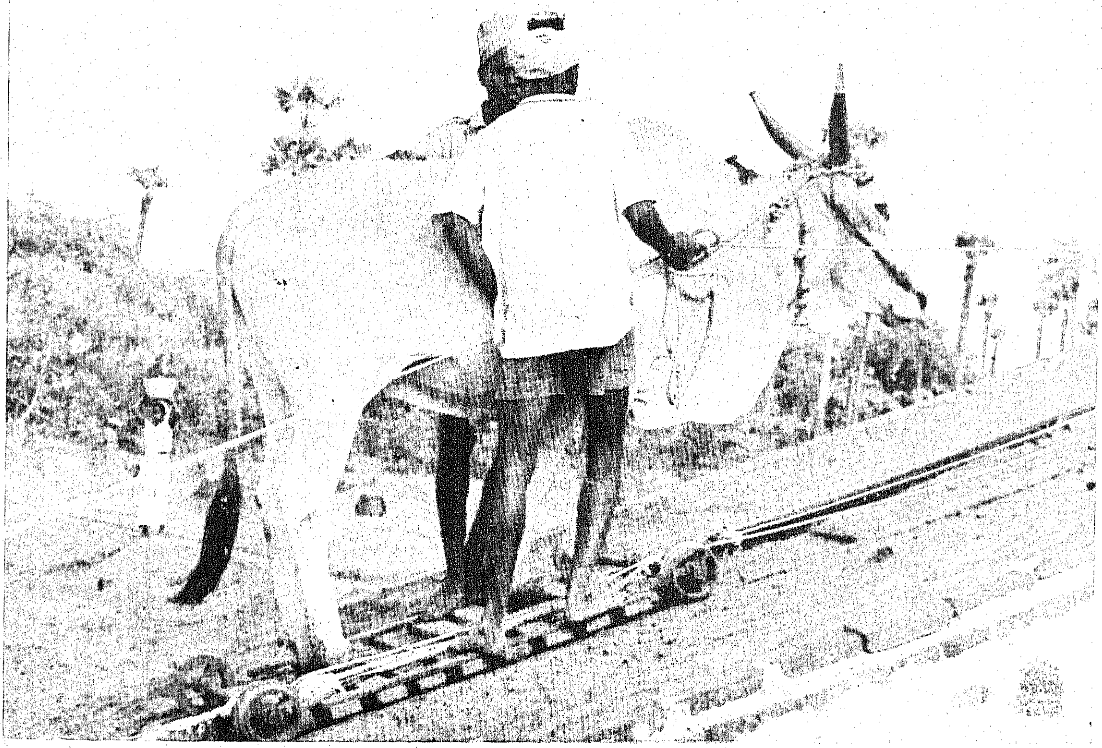


Fig. 1. On the move down

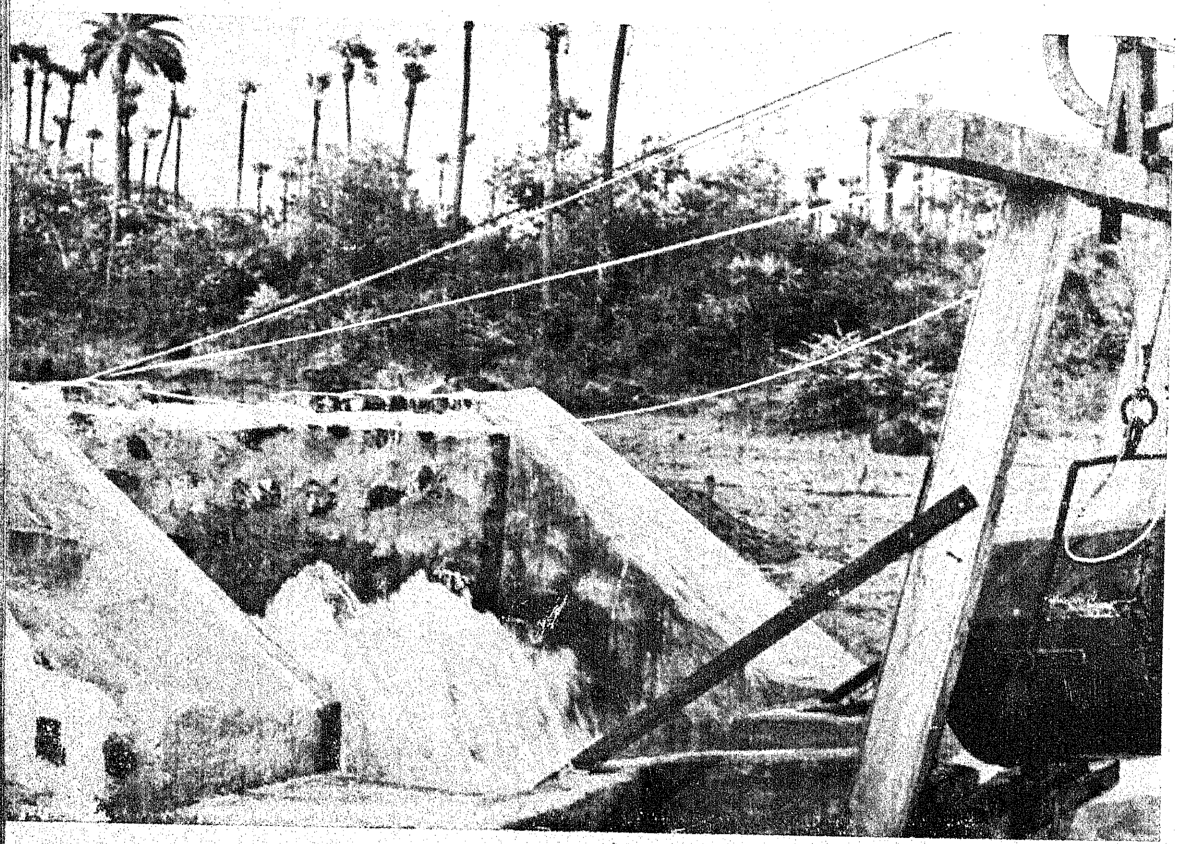


Fig. 2. Bucket discharging water

the ramp and repeats operation No. 2 ; meanwhile, the animal goes up and mounts the trolly as explained in No. 3.

## *Capacity and cost*

The capacity of this lift for discharging water, working at an average speed, with a 33-gallon bucket for 6 hours a day on a 3 to 1 gradient, may be taken as under, allowing 3 gallons per bucket for spilling and increase of depth as the water level goes down :

| Average depth | No. of buckets per hour | No. of gallons per hour |
|---|---|---|
| 15 ft. | 100 | 3,000 |
| 20 „ | 90 | 2,700 |
| 25 „ | 80 | 2,400 |
| 30 „ | 70 | 2,100 |
| 35 „ | 60 | 1,800 |

It is quite easy to work the animal 6 hours a day in two shifts of 3 hours each. The animal has simply to walk up the ramp, mount on the trolly, glide down and dismount for each bucket. The distance that the animal has to walk up per day of 6 hours works out to :

| | | | |
|---|---|---|---|
| For 15 ft. depth | 15 × 100 × 6 | — | 9,000 ft. |
| „ 20 „ „ | 20 × 90 × 6 | — | 10,800 „ |
| „ 25 „ „ | 25 × 80 × 6 | — | 12,000 „ |
| „ 30 „ „ | 30 × 70 × 6 | — | 12,600 „ |
| „ 35 „ „ | 35 × 60 × 6 | — | 12,600 „ |

The pre-war price of the lift, complete, for a well 30 ft. deep. was about Rs. 160. But the present price will be about Rs. 400. The ordinary earthen ramp with slight regrading can be used.

## *A simple device*

The training of the bullock is simple and even the most recalcitrant should not take more than a week or ten days, and a ryot with average intelligence can train the animal and operate the lift successfully. The weight of the animal is the motive force and, considering that no heavy exertion is entailed, old and unserviceable animals suffering from yoke-galls, etc. and even buffaloes can be used for the purpose. The main advantages of the lift are :

(1) It is built on sound engineering principles and is simple and efficient.

(2) Any animal can be used and trained easily.

(3) One animal does the work of four animals without much exertion. The animal has rest for more than half the time during the day's work, while it glides down and also when it remains stationary after dismounting and before the next bucket is filled.

(4) There is no backing, heaving, straining and pulling associated with the primitive method employed in the *mhote*, and consequently animals used on this lift are bound to outlast and remain more healthy and serviceable than those working in *mhotes*.

(5) The depth of the well does not matter : it will only entail a longer ramp.

Although this lift was invented as early as 1914, it has not received the publicity and encouragement it deserves owing to lack of enterprise, want of capital and organization. The conservatism of agriculturists generally, and inadequacy of a sufficient number of mechanically-minded ryots to handle this simple contrivance probably militated against its adoption when it was first introduced. Once the principle underlying the construction of this lift is properly understood and receives adequate recognition, there should be no difficulty in fabricating these lifts in every village in conformity with approved specifications. The buckets could be made in different standardized sizes to suit the weight of animals available.

In course of time, it should be possible for the ryot to get from the nearest cattle fair or from his own village itself animals fully trained for work in this lift in the same way as he has been getting animals trained to the plough, cart and the *mhote*. The handling and maintenance of the lift will be child's play to the vast army of technicians now on field service when they return to their homes and take to agriculture again after peace is restored.

# THE SURTI GOAT

By B. B. Jamaspjina

THE Surti goat is a medium-sized, smooth-haired, white animal with small thin ears, big udder and a small head. Good specimens of this breed are encountered in many cities of the Bombay province—especially in Surat, Broach, Poona and even in Bombay.

It is essentially 'a city goat', because it stands confined conditions and stall-feeding well and does not walk a long distance in search of food, as other goats do. It thrives best on all kinds of garbage, particularly vegetable and other green offal and grain sweepings. Its milk yield is high ; and the lactation period is long.

### *The poor man's goat*

The poor and middle-class Muslims keep this breed for two considerations : (i) good milking quality, combined with docility and quality to thrive under confined conditions and (ii) religious. The breed owes its origin to the Arabian or Mesopotamian goats.

Well-water, milk, syrup, flowers and dates form the simple religious offerings in all Parsee fire temples. Goat's milk being available on the spot at all times of the day, most of the old fire-temples maintain two or three milking goats of the Surti breed ; particularly those situated in villages and small towns.

The origin of this breed is interesting. At one time Surat was the most prosperous and important harbour on the west coast of India. All foreigners from the west called at this port. The Muslim traders always carried a large part of their food in the form of live goats and sheep. The Haji Muslims of India on their return followed the same practice. This is how some of the best goats, mostly bucks were brought to Surat. The resultant breeding and cross-breeding between the Arab bucks and local does, developed into the present-day Surti goats. Broach and Cambay, in Gujarat which were also important ports at one time, possess some good specimens of this breed. Very fine specimens of the Surti goats, or good milking Aden goats, are still to be seen with the Hajis at the Muslim *musafirkhana* near Crawford Market in Bombay.

### *Characteristics*

Unlike most of the Indian goats, the Surti has a small head, small thin ears, small thin horns, or completely hornless, medium height, small hoofs, and clean short hair. In Surat and Bombay, however, a superfine class of goats known as 'Pateri',—a sub-breed of the Surti are found. It is definitely hornless, wattle-less, with small thin wafery ears and a big udder with two long teats. It is a picture of fineness and tenderness.

The following is a detailed description of the physical peculiarities of Surti breed :

*Colour :* White hair, dull in lustre. Sometimes light fawn to dark fawn or brown colour is seen. Black colour is a defect, but black spots are seen in half-breeds. With fawn colour on body the head is generally darker in colour with two white-coloured streaks running down from forehead along the cheeks up to the muzzle. This gives a camouflage colouring effect as in some kind of deer.

*Coat :* The hair is short and devoid of lustre. There is an absence of loose, long hair above the hock on the hind legs. Its presence is considered a defect. The skin is thin and loose.

*Head :* The head is small, with a short nose. The nose is flat and should never be aquiline. There is absence of horn, or sometimes small twisted thin ones running backward along the neck. This breed is beardless, but may sport small thin wattles. The head is carried high and erect like a deer.

*Body :* The body is angular loosely set upon four thin short legs. Tallness is considered a defect.

The breeding and milking propensities of this breed require to be fully utilized and developed further. Milk from 3½ to 5 lb. a day is easily obtained, and some individuals have been said to yield up to 6 lb. a day. The lactation period is long, with a very short dry period. At each kidding, two kids are dropped usually, three are fairly frequent and four at-a-time is not a rarity. The kidding takes place twice a year. One animal has been seen in Bombay to give four kids twice each year ; and another with four teats—all milking. With such high efficiency in economic characters, the breed has endeared itself to goat-fanciers in such a way, that many refuse to sell their stock, and whatever is offered for sale is always at a high price beyond the poor purchaser's means. The

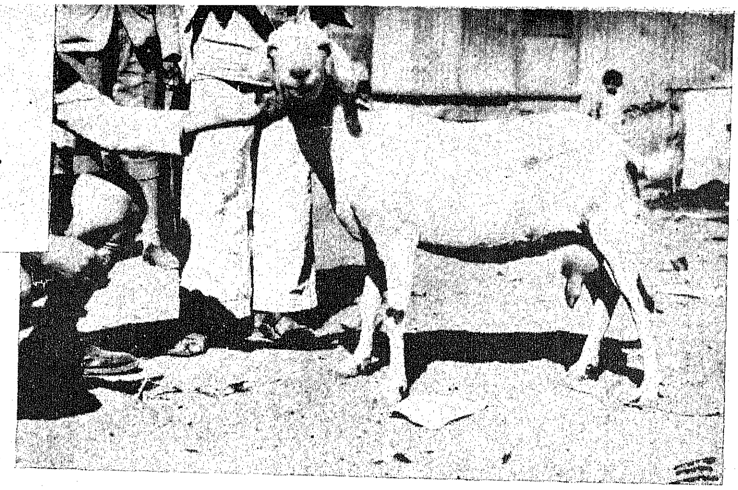


FIG. 1. A good specimen of 'Surti' goat

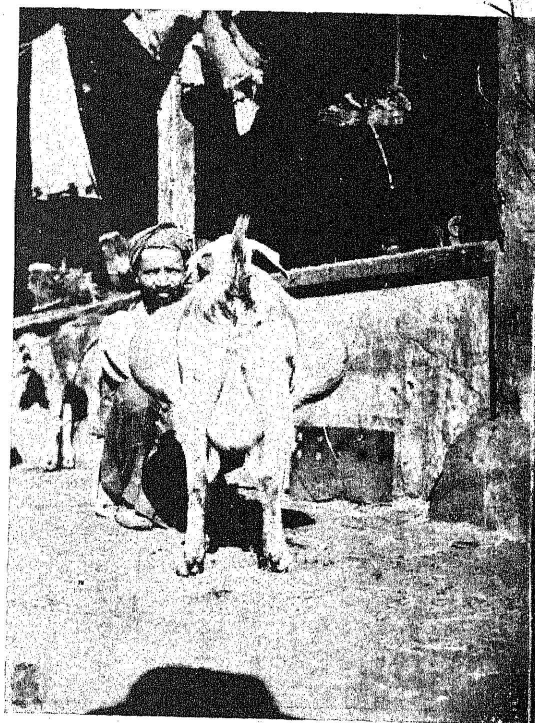


FIG. 2. At each kidding, two kids are dropped usually. Three and even four are not uncommon

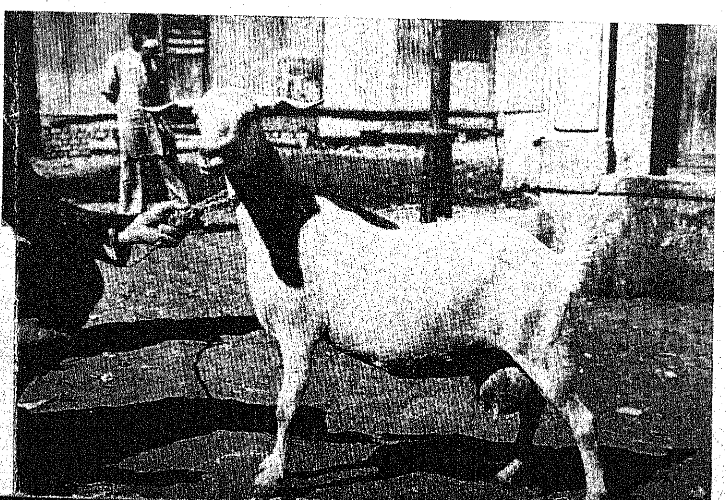


FIG. 3. Pateri, a sub-breed of Surti

PLATE 40

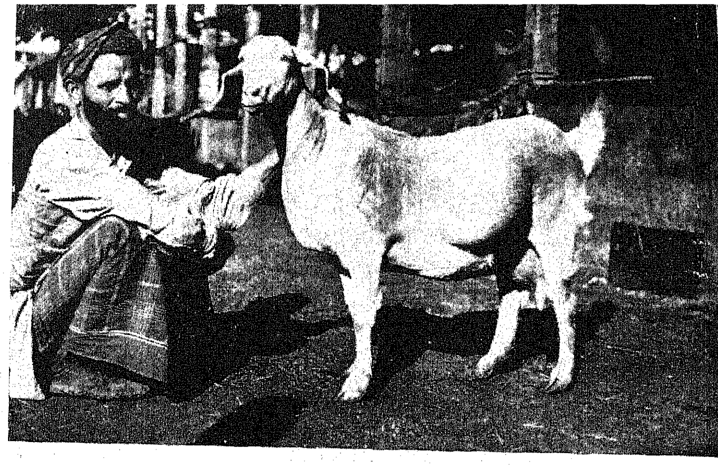


FIG. 4. The Surti goat has a small head, small thin ears, small thin horns or completely hornless and is of medium height

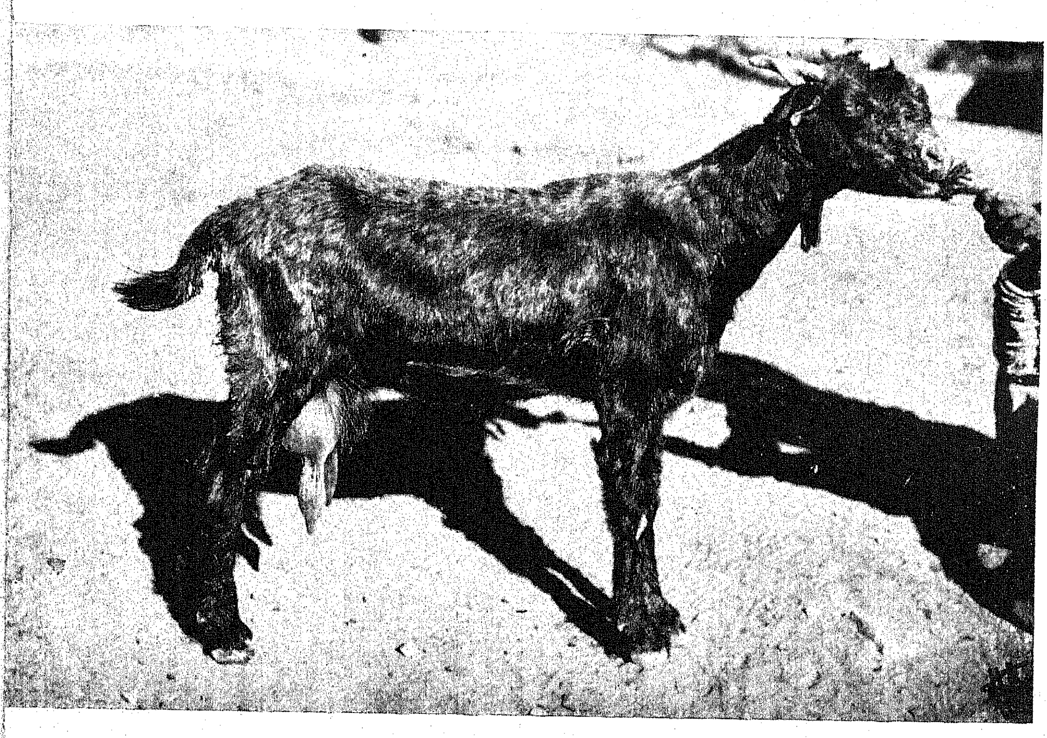


FIG. 5. Kathiawari Breed with long, rough hair, big rough head and aquiline nose

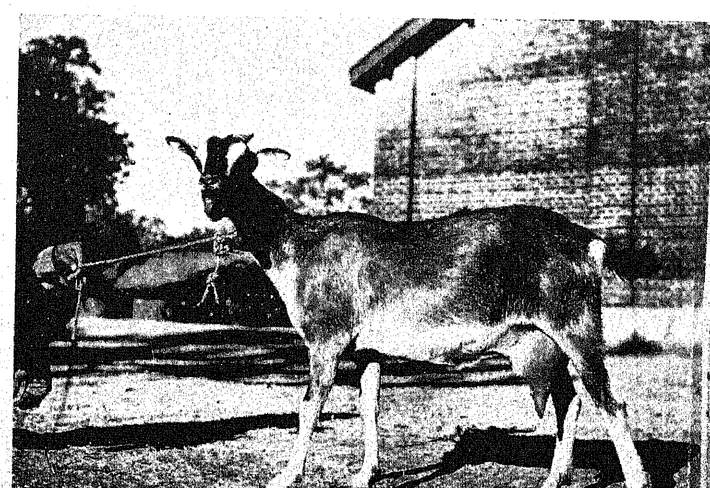


FIG. 6. With fawn colour the head is generally darker in colour with two white streaks

writer has heard of the following top-notch prices before the war :

At Bombay : buck at Rs. 25 and doe at Rs. 40 each ; at Rander (near Surat) : buck at Rs. 20 and doe at Rs. 35 each.

In spite of their refusal to sell, large numbers are not to be found with individual keeper. This paradox is not explained satisfactorily by any breeder or keeper ; but in Bombay it has become a problem to rear a kid up to maturity, and in Surat the young are not much cared for.

### *More care needed*

The goat as a class has fallen into disfavour now-a-days, due to its great foraging habit. It has been credited with laying bare all vegetation, hills and dales, and thus indirectly help soil erosion, a problem which is now in the forefront of all agricultural improvements. But the fault lies not with the goat, but with the goatherd, who has never cared for the improvement of its stock and has profited by grazing free on others' lands. All animal life under controlled grazing, improves the grasses and vegetation by natural selection and increases fertility by their excreta. So is the case with goats. The Surti breed, or any other breed of goats with such high economic characters, requires special attention and more fostering care in increasing the number. The increase in number will produce more milk which is suitable for weak stomachs.

Goat's milk produces a curd rather flaky in consistency, but when drained it settles in a firm mass. This quality in goats' milk has made Surat and Dhond famous for their cheese or *panir* in Bombay, Ahmedabad, Surat and Poona.

## PHENOTHIAZINE - SALT MIXTURE AS AN ANTHELMINTIC IN SHEEP

AFTER the dependable vermicide action of phenothiazine was proved experimentally and in field use, the large (bulky) dose required, the insolubility of the drug and the repulsive taste imparted to feed, made its use cumbersome in large flocks of sheep, until it was discovered that mixing phenothiazine with common salt at the rate of 1 to 15, and giving the animals access to the mixture in lieu of the usual salt allowance, was proved markedly effective in expelling the more common Nematoda infecting ruminants. Britten, Cameron, Miller and Cameron, University of California, who have used this simple method extensively under a variety of conditions, report that the drenching of animals individually with solutions of nicotine and copper sulphate may be largely discarded. The authors conclude : 'Phenothiazine at the rate of 1 to 15 is effective in controlling the common roundworms in sheep under California conditions.' At this concentration, the mixture is non-toxic when animals are allowed free access to it over a period of 11 month.—*The Cornell Veterinarian*, October, 1943.

# IRREGULAR BEARING OF MANGO[1]

By P. K. Sen, M.Sc., Ph.D.(Lond.), D.I.C.

*Horticulturist, Bihar and Officer-in-Charge, Joint Plains Fruit Research Scheme, Sabour, Bihar*

THE mango claims over 11 *lakh*[2] acres which is by far the largest area under any single fruit crop in India. It is grown all over the plains and up to about 3,000 ft. above sea level. It is the best and the most adored fruit of the land. And for its wholesome quality and taste it also promises an overseas market. Besides it lends itself to the making of excellent preserves and to canning. Development of Indian fruit culture depends a great deal on the development of cultivation and marketing of the mango.

But the irregularity of its bearing presents a serious handicap in the way of this development. The mango does not crop equally well every year. A good crop is usually obtained once in several years. Regular supply of the fruit is essential for establishing a reliable market. Machineries for storage and transport, or for canning and other utilization cannot be suited to conditions of irregular cropping. Were it possible to secure regular cropping of the mango, an important fruit industry could be developed in the country which would very highly augment its income.

Thanks to the Imperial Council of Agricultural Research, it did not lose time to take up in hand this question of the mango. It has initiated studies on the problems of mango culture under a joint plains fruit research scheme at Sabour, Bihar.

## *Irregular bearing*

The mango is well known to be an alternate bearer. In reality, however, there is no pattern in the sequence of its bearing except that a heavy crop in one year is followed by a period of poor crop—the period may consist of one, two or more years. It is a matter of common experience that when in one year the tree produces a good bloom and crop, it produces little or no bloom in the year following. It usually blossoms again after an interval of one year, but often enough the interval is found to be longer than a year. Then again a good bloom is no guarantee of a good crop. In some years the bloom is spoiled by untimely rains during the time of flowering, in some others it is damaged by excessively hot wind. Incidence of pests like mango hoppers locally known as *madhua, lahi, lasha* or *cheep*, is another factor which damages the bloom. Also storms and hail-storms beating and dropping the young fruits are well known odds for the mango. Thus it is only when the bloom is good and the weather is favourable, and there is no disease and pest, that a good crop of the mango can be obtained. Such a combination in nature is not regular. And it is a fact that till now the growers in general do not give much cultural attention to the mango. It hardly receives any regular cultivation, manuring, irrigation, etc. It is left more or less to nature so that its cropping cannot be regular.

## *Factors affecting yield*

The number of fruits borne on a tree is determined by (i) the number of blossoms which form and (ii) the percentage of these blossoms which set and yield fruit. The mango presents problems with regard to both. Firstly, it does not blossom regularly and secondly, blossoms cannot always set and yield fruit.

Irregularity of blossoming, however, is really more often the cause of failure of the mango crop, because, fortunately, the extremes of weather or diseases and pests, which may spoil the bloom, are rather exceptional than general. The mango has a natural tendency to produce heavy and light bloom in alternate years. If appropriate blossoming could be secured annually it could be made to crop practically regularly. It presents little problem as regards the setting of fruit. Unless the weather is bad or there are pests, fruits set in quite freely. Amongst the weather odds

[1]For a detailed and more technical consideration of the subject reference may be made to the article on 'The bearing problem of the mango and how to control it' by the same author published in the Indian Journal of Horticulture, Vol. I, No. 1, June 1943.

[2]Vide statistical table A (b) in the brochure published on the occasion of the fruit and fruit products exhibition in Calcutta, in January 1942, obtainable from the office of the Senior Marketing Officer, Bengal, Writers Buildings, Calcutta: 10 *lakh* = 1 million.

heavy rain during the time of flowering is the worst enemy, for it is difficult to protect the blossoms against it, but the adverse effect of hot winds can be effectively minimized with the help of wind-breaks. Diseases and pests are not common in clean, well-kept orchards, except hoppers which breed in great numbers during the flowering period if the weather is cloudy.

### *Biennial bearing habit*

The tendency of producing heavy and light bloom in alternate years is not peculiar to mango alone. The apple, avocado, sweet prune, loquat, persimmon, certain varieties of citrus, coffee and many other tree fruits suffer from this habit. This is known as biennial or alternate bearing habit because it results in heavy and light crops once in two years i.e., in alternate years. The alternate bearers show a characteristic antagonism between their conditions of growth and fruitfulness. In the year they produce heavy bloom and yield a heavy crop, the tree becomes exhausted. It has few bearing wood from which to flower in the following year. In the next year when the tree produces little or no bloom it makes plenty of new growth, accumulates plenty of reserve food and flowers heavily again in the year following. And in this way the tree develops an 'on' and 'off' yearly rhythm which goes on regularly until some adverse weather conditions or serious attack of disease or pest upsets it.

Poor flowering in the 'off' year is the result of poor growth in the 'on' year and heavy flowering in the 'on' year is the result of excessive growth in the 'off' year. And it has been determined that annual flowering can be secured if the tree can be made to produce appropriate growth annually.

### *Growth habit of the mango*

The mango begins its new year as the winter begins to subside and the bloom marks the beginning. Immediately following the bloom it produces a flush of new growth, in spring. A second flush of growth appears in summer, from about the end of April to May. A third flush often appears later in the rains. These are the three main flushes of growth but there may always be a few new growths here and there on the tree, and there may even be an extra flush depending on the rainfall condition and other growth factors. With the end of rains and initiation of winter the mango shows a check in growth. Under the north Indian conditions such a check takes place sometime between October and December. And it has been determined that the buds for the following year's blossoms are differentiated during this time.

Between the growths of the various flushes those appearing in spring and summer are generally the ones which can produce flower in the next year. The conditions which favour flowering are that the shoots should cease length growth and accumulate sufficient reserves before the time of flower bud formations. The spring and summer growths get sufficient time to grow and mature for the purpose, but the later growths do not get the time to do so. In the 'on' year the tree produces little growth in spring and summer but in the 'off' year it makes plenty of new growths early in the season. It accumulates plenty of reserve food which changes the nutritional balance in the tissues of the tree. The proportion of nitrogen decreases. Such a condition favours fruitfulness but it inhibits growth. The accumulated reserves are used up in the 'on' year when the tree bears a heavy bloom and crop but produces little new growth of foliage to manufacture food. As a result the proportion of nitrogen again increases in the tissue. This condition inhibits flowering but favours growth.

The mango tree develops the biennial bearing habit from its early stage when it comes to fruiting[1]. During the early years it tends to bear regularly biennially. But as it grows in age it becomes irregular because it fails to make sufficient growth and recover quickly after bearing a heavy crop. And under conditions of cultural neglect, which is more or less the rule at present, such irregularity is the general feature, because under such conditions the tree does not get enough nutrition and moisture in the orchard soil and it may be exposed to the attack of diseases and pests.

On the other hand, it has been found that a moderately regular crop can be obtained by proper cultural care of the orchard. The object aimed at in such a case is to maintain the trees in healthy growth, and to induce summer growth every year. The trees can be kept in general health by regular ploughing, manuring and irrigation. And it has been experimentally

[1] See Annual Report of the Fr. Res. Stn, Sabour, Bihar for the year 1940-41.

found that summer growth can be induced even in the 'on' year by additional nitrogen manuring.

Besides nitrogen, moisture is another factor which is important in relation to growth and fruitfulness. Plenty of moisture is essential for growth, but dry conditions of the soil and weather favour formation of flower bud. It is, therefore, as essential to provide moisture by appropriate irrigation in summer, as it is necessary to overcome the adverse effect of wet condition of the weather on the formation of flower bud in autumn. Root exposure, application of salt to the soil round the tree and ringing have been found useful for arresting growth and stimulating flowering.

Some inferior mangoes show annual bearing character. They can make growth and bear annually. All the best varieties, however, show the biennial habit. The more intensively[1] biennial a variety is the more difficult it is to control its behaviour. One of the aims, therefore, should be to grow varieties of mangoes as have satisfactory market qualities, but do not exhibit the strong alternate bearing tendency. Work is in progress at Sabour on the selection and breeding of varieties in this respect, as well as on the physiology of the mango in order to determine the optimum methods of manuring, irrigation and other cultural care that have bearing on its growth and fruitfulness. Meanwhile, the following tentative cultural schedule is recommended as an aid to regular bearing of the mango. This will ensure a fairly regular bearing unless it is upset by external calamities outside the control of man.

### *Aids to regular bearing*

1. Trees should be planted well apart from one another, 30 ft. to 40 ft. according to variety, climate and soil. Wind-break should be planted on the *loo* (hot wind) side of each area.

2. Regular ploughing of the orchard is essential. Usually an orchard should be ploughed three times a year—once during winter, once following the first showers in summer and finally towards the end of October or early November. Depending on the condition of growth of the trees, the number of ploughing may be increased or decreased. If the trees make very vigorous growth, summer and/or late rain ploughings may be cut down. On the other hand if the soil and the trees demand, the orchard should be ploughed as often as possible. Ploughing helps to retain soil moisture and also to add compost to the soil by digging fallen leaves and weeds into it.

3. A general manuring of the orchard soil with farmyard manure or compost at the rate of 10 cartloads to the acre should be done every year. Under the north Indian conditions it is recommended to apply this manure at the time of ploughing in October-November. The manure applied at this time becomes available to the trees in another two to three months in spring at the time of fruit set and initiation of new growth.

4. Trees should never suffer from nitrogen starvation. Excessive nitrogen again is no good as it makes the tree strongly vegetative but shy in bearing. If in any year a tree fails to produce sufficient new shoots during summer, nitrogen should be applied to it in a quickly available form, e.g. sulphate of ammonia at the rate of 5 lb. (for 6 to 8 years old trees) to 10 lb. (for 15 to 20 years old trees) about the beginning of June, three or four weeks before the rains set in. The best way to apply this manure is to spread it and dig it in the soil round the tree in a ring, about 3 ft. to 4 ft. wide, under the outer fringes of its canopy. After the manuring, irrigate once lightly at the first instance and then give a liberal irrigation after two or three days.

5. Irrigate the trees soon after the fruits form. It is convenient to irrigate young trees in ring channels. For older trees it is advisable to irrigate the orchard by running water through cross furrows between trees. Irrigation will help the developing fruits and at the same time induce new growths.

6. Ringing may be necessary: Where the rainfall is within 30 in. and where there is usually no late rains, no special treatment is generally required for inducing flowering. Length growth of the new shoots is naturally checked early enough for the formation of flower buds. Where rainfall is high or late rains prevail, flowering can be induced by ringing. Ring branches which are about 3 in. to 5 in. thick. Remove bark in a ring $\frac{1}{8}$ in. to $\frac{1}{4}$. in wide by clean cuts. Plaster the wound with grafting clay which can be easily prepared by mixing into a paste with water, one part fresh cowdung and two parts good soil. This helps healing of the wound. Under Sabour conditions the first week of August has been found to be the best time for ringing. The object should be to ring the tree at such a time that the effect is obtained

[1] Biennial intensity=the violence with which crops fluctuate.

before the time of flower bud differentiation in October-November and at the same time the wound heals up within the current season. Two half rings on the two sides of a branch, one about 2 in. apart from the other is preferable to one complete ring, as the former method is less drastic but almost equally efficient.

7. Regular ploughing will keep the orchard clean. The orchard top should also be kept clear by judicious cutting off of branches (and removing alternate trees in old or congested orchard) in order to give the trees plenty of sunlight. This will reduce the incidence of pests and diseases, as well as make the trees productive.

8. Dusting or spraying : To control hoppers, sulphur dusting or spraying with fish-oil rosin soap is recommended. (i) Use finely powdered sulphur and dust thoroughly soon after flowering when the nymphs of the insects begin to appear on the developing floral shoots. Give two more dustings at fortnightly intervals. Dusting should be done on a clear day and it should be borne in mind that if the sulphur is washed away by rain within two or three days the dusting should be repeated. It is best to dust the sulphur when there is no strong wind. (ii) Give two rounds of spraying with fish-oil rosin soap at a strength of 1 lb. in 10 gallons of water, one at the time when flower buds begin to swell and the other about a fortnight later when flowers open out.

## SMOKERS SPREAD TOMATO DISEASE

BLANK your cigarette and wash your hands before working around tomato plants. This is not another of those wartime regulations, but sound advice to follow at all times.

A good crop of tomatoes comes only from strong, healthy plants. A tomato plant infected with a virus disease, such as mosaic, puckers up its leaves. Its size is skimpy and its growth, spindly. Yet many gardeners tying, cultivating and harvesting tomatoes unconsciously spread this disease.

Plant pathologists of the Dominion Department of Agriculture say that tomato mosaic is found not only in tomatoes, but in tobacco. They say that it has been proved that the use of tobacco by gardeners working with tomatoes may be responsible for infecting the plants with mosaic. They have demonstrated in the Dominion Laboratory of Plant Pathology at St. Catharines, Ont., that tobacco may adhere to gardeners' fingers and be spread, by contact, to tomato plants during such cultural operations as pruning, tying and suckering.

The danger of smokers spreading mosaic is greatest when they use natural leaf tobacco, or when they roll their own. But mosaic is found in most brands of smoking tobacco and of chewing tobacco, too. For this reason, men who 'chew' should spit out their quid before working in the garden around tomato plants.—*Department of Agriculture, Canada.*

# INSECT DAMAGE AND CROP HEALTH

By K. B. Lal

*Entomologist to Government, United Provinces, Cawnpore*

THERE is a prevailing impression, even amongst people otherwise well-informed on agricultural matters, that insect damage in crops is an indication of the latters' poor health ; that if a crop is well and properly grown little injury may be caused to it by insect pests. The analogy is given of human health that if a man looks after himself well and takes proper and adequate nourishment he need not have much fear of diseases and ailments. Unfortunately the analogy is wrong because no matter how well-fed and cared-for a man may be he does not always escape accidental infections and attacks of such diseases as malaria, typhoid and cholera. Indeed the analogy may well be pointed in the other direction, since both crops and men, in the best of health, may suffer from disease and pest attacks.

The idea that a well-grown plant successfully resists insect attack was forcefully expressed by the great agriculturist, Sir Albert Howard in 1936 to which a convincing reply was published by A. G. Bebbington and W. Allen based upon their observations of cotton pests in South Africa. One of the important points made out by the latter workers was that cotton stainers in Africa did not attack all cotton plants indiscriminately but only such of them as appeared to be healthy and most vigorously growing. It has not been unusual, however, to find Sir Albert's idea being vaguely repeated by non-entomologist agriculturists in their advice to cultivators regarding the protection of crops from insect attack. For instance, one recommendation in respect of sugarcane says : 'every agricultural operation efficiently carried out, acts in itself as simple, practical preventive measure against diseases and pests' and further that 'proper timely operations.. also act indirectly by improving and maintaining the vigour of the crop and thus its resistance to attacks of pest and diseases'. Such statements are at best only half-truths and tend to create a kind of complacency which may lead to more harm than good. Let us examine, therefore, the relation of crop health to insect damage.

## *Crop health and insect pests*

There are generally two types of insects: those with biting mouth parts and those with sucking mouth parts. Both attack plants and cause damage, primarily because they want food. This food is obtained from the various parts of the plants at certain stages of their growth and it should be reasonable to assume that if the plants are not growing well or are diseased, either the insects will not find enough nourishment on them or find it not exactly to their liking. As an obvious example may be cited the fact that no crop pest will readily feed on dead or drying leaves of its host plant. But for this fact entomologists, in rearing their insects, should not be under the necessity of constantly changing their food plants to keep them in fresh condition.

In the case of sucking insects, the plant juice must be of a certain chemical constitution and of the required degree of acidity or alkalinity to be palatable to the insect and it may be possible to so alter the nature of the juice (without adversely affecting the economic quality of the plant product) as to make it unpalatable. It is well-known that many plants are naturally resistant to the attack of insects and plant breeders have been continually busy evolving varieties resistant to this insect pest or that but the factors conferring resistance have had no relation to the health or the vigour of the plants. Hairiness of leaves, hardness of mid-ribs, toughness of fruit skins, acidity of the cell sap, etc. have been considered to invest plants with powers of resistance against one insect or another but it has never been suggested that these and similar characters can be induced or modified in plants by simply growing them under the best of general conditions.

Sometimes what is believed to be insect resistance may be more correctly described as insect avoidance or insect endurance in plants. In such cases the plant comes into a stage of growth, attractive to an insect pest, shortly before or after the latter has become abundant in the field due to climatic and other reasons. The attack of the *gundhy* bug is most severe

when the paddy plants are in the 'milk' stage but if this stage occurs when the population of the pest is low the crop may escape injury. Some plants may endure insect attack either by vigorously putting forth new shoots and leaves and repairing injury as in the case of the attack of the stem weevil on cotton plants in south India or on account of having passed the stage when the pest could do most harm as in the case of the *gundhy* bug and paddy, but instances in which merely vigorous growth on the part of the plant will ward off insect attack are rarer than is generally believed.

### *Anti-insect measures*

Insect avoidance or insect endurance may be brought about by cultural operations but to be really effective the latter must be judiciously selected and planned. Time of sowing, crop rotation, irrigation, manuring, clean cultivation, etc. have undoubtedly definite and substantial values as anti-insect measures provided they are undertaken not haphazardly but with reference to specific insect pests because they act not so much by increasing the vigour of the plants as by creating conditions directly unfavourable to the pests. For example, earthing up of cane plants has been considered a good cultural practice as well as a fairly effective check against the stem-borers but to serve the latter objective also the number and time of the earthings must be carefully chosen. Heavy irrigation of wheat crops has been observed to reduce appreciably attack by termites but this result was achieved not because the plants suddenly improved in health but because the excessive humidity of the soil acted adversely on the termites.

The term 'clean cultivation' in agricultural practice, in so far as it is considered to keep off insect pests, appears to be a much misunderstood term for which the entomologists themselves cannot be entirely absolved from blame. What the term should imply is the selective destruction, on as wide a scale as possible, of weeds, grasses and other plants or the prompt removal of crop residues harbouring insect pests in any stage which may sooner, or later attack cultivated crops in the neighbourhood.

It should be desirable for a cotton grower, for instance, to know and destroy during certain seasons the alternate host plants of the spotted bollworms growing near his fields but the indiscriminate destruction of every unwanted plant may entail unnecessary labour and expense without resulting in any appreciable relief from the pest.

It may be argued that an insect may or may not spare a healthy plant but the latter on account of its vigour would be much less liable to suffer than an unhealthy plant. This again is not an entirely correct view because the extent to which a plant will suffer would depend much less on its own vigour and much more on the attractiveness of its stage of growth to the insect pest and the strength of the latter's population in the field. Insects become pests only when they multiply in large numbers. If climatic and weather conditions are favourable for this multiplication and natural enemies are scarce for any reason and host plants in the right stages of growth are abundant, the insect pest will increase unchecked and attack its favourite plants no matter how vigorously they are growing. Indeed, the vigorously growing plants may well be more attacked since they provide more leaf surface, more flower buds and fruits and more juice.

### *Unhealthy plants rarely attacked*

Let us switch on to another and more important aspect of the relation between insect damage and crop health. Surprising as it may seem to some, there are few crop pests which attack, by preference, unhealthy or weakly growing plants. Locusts and grasshoppers are notoriously known to be fond of fresh, succulent leaves of cabbage, cotton, *jowar*, maize, brinjal, etc. The woolly aphis deserts apple trees as soon as they become weak and sickly as a result of its own attack on them. The pyrilla has been well known to attack sugarcane varieties having broad, succulent leaves and its infestation has been generally observed to be much heavier in well-manured and irrigated fields under crops showing dense foliage and sappy and luxuriant growth than in unmanured fields with poor crops.

Recently a chemist reported a severe attack by root borers to certain varieties of cane under manurial trials in the Gorakhpur district and made the interesting observation that the more healthy and vigorous growing plants, as a result of suitable or excessive manuring, were suffering more heavily than those not so well growing. Many years ago the present writer treated some Punjab-American cotton plants at Lyallpur with ammonium sulphate, soda nitrate and other fertilizers and obtained quite a healthy and luxuriant growth. Observations made soon

after showed that a severe attack of aphids had developed on all the plants while those left as controls and poorly growing had very few aphids on them.

In the numerous studies and reports on such well-known insect pests in India and elsewhere as the pink bollworm of cotton, the moth borers of sugarcane, the mealy bug of mango, the codling moth of apple, the coconut caterpillar, the fruit flies, etc. there has been no suggestion that they attack unhealthy plants more than healthy ones. On the other hand, there have been any number of definite observations indicating that the pests preferred healthy and well-growing crops. What then is the basis of recommendation, so often and so lightly made, that by growing healthy and vigorous crops the cultivator will automatically avoid pest attack ?

### *Causes of insect demage*

One reason, of course, is the mistaken belief that insects will find it easier to attack weak rather than strong plants, forgetting that insects should want good, well growing food just as well as man himself would. Another reason may arise from faulty observations made by some people. Many insects cause distinct and characteristic symptoms on the plants they attack not only by their mechanical feeding but also by injecting toxic substances and virus and other disease germs into them. When the plants quickly become sickly as a result of the latter causes it is often assumed that their ill health has attracted the pests. In other words, the insect pest is considered the effect rather than the cause of the disease. This is well illustrated by the example of the cotton jassid attacking cotton, lady's finger and other plants in the Punjab and elsewhere. There is the characteristic mottling, yellowing, bronzing and curling of the leaves, which doubtless are the results of toxins or diseases introduced by the jassid. The plants become very unhealthy on which the jassids are also present in large numbers leading to the impression that they are attacking only such plants.

A third reason may be the habit of certain groups of insects to feed only on decaying or dead vegetable matter. Such cases are well-known in the beetle families of Mordellidae, Nitidulidae, Lucanidae, Eucnemidae, etc., many species of which attack dry or decaying wood, fermenting vegetable matter, souring fruits, decomposing bark and sapwood, etc. Such insects, however, are of specialised habits requiring certain types of food which they can not obtain from the healthy, well growing trees. It will, therefore, clearly be wrong to rely on their analogy to believe that healthy crop plants in general will be less liable to attack by insect pests than unhealthy ones.

Yet another reason may be the vulnerability of some plants to suffer from and even succumb to the attack of insect pests when they are young but to successfully withstand the same when they have grown in age. Very young mango plants are often killed by the attack of termites or scale insects while these pests may not cause much harm to a well-grown mango tree. Here the attack has relation to age and not to the vigour or health of the plant.

It appears, therefore, that the extent or the intensity of insect attack on a crop is not necessarily determined by the health or the vigour of the plants and the general recommendation to grow crops well by paying proper attention to irrigation, manuring, clean cultivation, etc., as a means of protecting them from insect pests, is unhelpful and even misleading unless specifically qualified with reference to specific pests.

By all means grow your crops well—it would be absurd to suggest anything to the contrary —but do not imagine that good cultural operations undertaken without specific reference to one or more pests, will by themselves save the crop from their attack. Let us also not forget that caring for crops is not like caring for human beings. In the latter case the relatives of a person would undertake trouble and expense to the utmost limit of their capacity to keep him healthy or to cure him of an ailment but in the case of crops the cultivator will spend his time and money only to the extent justified by the expected return from the crop. This return will depend not only on the yield of the crop at harvest time but also on various economic factors, such as the market price of commodities, over which the cultivator has no control. For this reason crops will continue to be imperfectly grown and even such problems of pest control as could be solved by first-rate cultivation alone, would occasionally have to be tackled by alternative methods, assuming for argument's sake that first-rate cultivation could be possible without taking definite measures for the control of insect pests.

# COMMON LICE OF INDIAN POULTRY AND THEIR CONTROL

By M. ATIQUR RAHMAN ANSARI, M.Sc.(PUNJAB)

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THE fowl is subject to the attack of a large number of external parasites belonging to distinct arthropod groups, viz. lice, mites, ticks, fleas, flies, etc. The attack by these parasites causes enormous damage which is not generally realized, and is one of the most important factors operating against the development of the industry. Of these, I shall deal with lice here.

The biting lice are small, flat-bodied, wingless insects which are permanent ecto-parasites both in juvenile and adult stages, on birds. Fragments of feathers, hairs, scurf, scales and other epidermal products are their staple food, but they do not miss casual opportunities of imbibing blood oozing from a bruise or due to haemorrhage. The greatest injury suffered by the birds is due to irritation and itching caused by the crawling of the lice on the body and to the persistent biting and gnawing of the skin by these parasites.

## *Injury due to irritation*

The violent irritation caused by the lice causes scratching, which in severe cases produces wounds on the skin and serves as inlet for disease producing organisms. A badly infested bird is in great distress, becomes restless and consequently emaciated, which predisposes it for the attack of pathogenic organisms. Moreover egg production falls.

*Control methods :* 'Prevention is better than cure' is too true in the case of pest control. Poultry houses should be well lighted, sufficiently ventilated and scrupulously cleaned every day. New birds should be kept in segregated runs for at least two weeks before they are turned in with home flock, and during this period the former should be treated for lice. The breeding fowls should be given special attention, because they are the media of distribution of lice and other parasites to the new flock.

A very satisfactory way of eliminating lice from the birds is to treat each fowl separately with sodium fluosilicate and country tobacco snuff in equal proportions. It can be applied by the pinch method or by means of a dusting can. In the former method, the fowl is held by the wings over a sheet of paper and the pinch of the poison is rinsed thoroughly into the feathers, placing small pinches of the substance at different parts of the body—head, neck, back, breast, vent, thighs etc. It should also be scattered on the underside of the wings and tail when spread.

If the number of the birds is sufficiently large, the affected birds should be dipped in an insecticide such as sodium fluoride and common tobacco snuff. Two ounces of the insecticide are added in one gallon of hot water and stirred well. Dip the bird in this solution, holding the wings over the back with one hand and ruffling the feathers with the other when the bird is below the surface of water, duck the head once or twice, take it out and hold it for a moment on the bucket to receive the draining solution and then let it go.

The dip should always be given on warm and sunny days, so that the treated fowl may dry quickly before retiring for roosting. Very weak and young birds should not be dipped, especially in cold and damp weather.

The life-cycle of the common head louse suggests that the control measures should always be repeated after about a week to eradicate the vermin completely.

# REPROCESSING OF DRIED FRUITS

By

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DRIED fruits like apricots, figs and raisins (green, red and black) which are imported from Afghanistan are usually of very inferior quality. Their colour and general appearance are very unattractive and their keeping quality is poor. On storage, they are readily attacked by insects or are spoiled by mould growth or fermentation. Besides, they contain large amounts of grit (dirt) and other extraneous matter. Raisins contain a large proportion of stems admixed with them. The Supply Department (Government of India) who had to purchase very large quantities of these fruits, desired that specific methods be developed for improving their colour, general appearance and keeping quality. Accordingly, samples of dried apricots, figs, black, green and red raisins, were sent to the Lyallpur laboratories by the Director of Foodstuffs, Supply Department, for reprocessing.

Reprocessing of these fruits was directed towards an improvement in their general appearance, the removal of grit and other extraneous matter by various pre-treatments, improvement in colour and keeping quality by sulphuring and a study of the effect of these treatments on diseased fruits.

## *Treatment of fruit for improving quality*

There are two important factors for consideration in reprocessing dried fruits. Firstly, any treatment of fruit with water for removing dirt and other extraneous matter, should entail minimum losses of sugar content through leaching. Secondly it should simultaneously provide necessary moisture to the fruit for effective and proper sulphuring with a view to improve its colour and keeping quality. Unlike fresh fruits which contain large amounts of water, dried fruits would not lend themselves to sulphuring treatment unless they have appropriate quantities of absorbed as well as surface moisture. Thus, these two factors are interdependent. In order to study these aspects of the problem, the following treatments were given to the samples of dried apricots, figs and black, red and green raisins which were afterwards dehydrated in a home-drier at 150° to 155°F. after draining off the liquid portion under each treatment:

(a) Boiling in water till the fruit was reconstituted.

(b) Soaking the fruits (separately) overnight in (i) cold water, (ii) hot water and (iii) one per cent potassium metabisulphite solution.

(c) Washing[1] the fruits in running cold water for 2, 5, 10 and 30 minutes. In this case each lot of fruit was sulphured, and then dehydrated.

Treatments (a) and (b) proved unsuccessful as large amounts of sugars of the fruit leached out in water on boiling or soaking. Washing the fruit in running cold water (treatment c) for more than 5 minutes also gave similar results whereas 2 minutes' washing did not induce sufficient moisture in the fruits for effective sulphuring. The absorption of water by the fruit increased with the time of washing and so did the absorption and final retention of $SO_2$ (sulphur dioxide), the best conditions being obtained by 5 minutes' washing. This washing prior to sulphuring was, found optimum both from the point of view of absorbing $SO_2$ uniformly as well as leaching out reasonably small

[1] Washing was done in a wash basin with an overflow arrangement by allowing a continuous stream of water to run on the fruit which was gently rubbed with hands.

quantities of sugar (this of course could not be helped as the fruit had to be provided with necessary moisture for adequate and uniform absorption of $SO_2$). Moreover, it improved considerably the general appearance of the fruit and at the same time removed most of the stems, grit and other extraneous matter.

### *Sulphuring*

The sulphur box used for sulphuring the fruits is a strong galvanised iron sheet box 3 ft. × 2 ft. × 3 ft. in dimensions. The sides and top of the box are enclosed in a wooden frame-work and the box is supported on an iron stand, and can accommodate 11 wooden flat bottom trays. A small glass window is provided at the hind end of one side, near the base, for burning sulphur. This window also serves as an inspection window. A small hole at the top near the front end helps to provide necessary draught for uniform circulation and distribution of the $SO_2$ fumes in the chamber.

*Volume-load relationship :* A large number of small-scale experiments were conducted to establish a relationship between the load and the volume of the sulphur chamber for efficient and uniform sulphuring, as it was found in preliminary experiments that variations in volume-load relationship seriously affected the absorption and final retention of sulphur dioxide in different fruits. As a result of these experiments, it was found that one ton of fruit properly distributed on trays occupies 1,000 cubic ft. chamber space, and that this volume and load relationship must be borne in mind while carrying out the sulphuring operation. On the basis of this relationship, a load of about 40 lb. of fruit worked out for the 18 cubic ft. sulphur chamber described above.

*Dose and time of sulphuring :* To determine the optimum conditions of sulphuring, doses of sulphur for all fruits were applied at the rate of 4 lb., 8 lb. and 16 lb. of sulphur per ton of fruit and the fruit in each case (after washing for 5 minutes) was exposed to the fumes of burning sulphur for periods ranging from 1 to 24 hours. All the samples were dehydrated and analyzed for $SO_2$ content. As a result of these experiments, the following doses of sulphur and the sulphuring periods were standardized.

| Dried fruit | Amount of sulphur burnt | Time of exposure to $SO_2$ fumes |
|---|---|---|
| Apricots | 16 lb. per ton of fruit per 1,000 cubit ft. of chamber | 3 hours |
| Figs | ——do.—— | 2 hours |
| Black raisins | 8 lb. per ton of fruit per 1,000 cubit ft. of chamber | 4 hours |
| Green raisins | ——do.—— | 1 hour |
| Red raisins | 4 lb. per ton of fruit per 1,000 cubit ft. of chamber | 1 hour |

*Dehydration of fruits :* After exposing the fruits to the fumes of burning sulphur for the required period they were removed and spread over wire gauze trays of the home-drier[1] and dehydrated at a temperature of 150° to 155° F. for periods ranging from 3 to 4 hours.

*Examination of reprocessed fruits.* In all cases the reprocessed samples assumed a much lighter, brighter and attractive colour in comparison with their original colour and kept in excellent condition in air-tight containers for about a year and a half. The original samples of all fruits, however, were badly spoiled and discoloured within about six months' storage.

Analyses of finally dried samples of the reprocessed fruits are given in Table I.

TABLE I.

*Analyses of reprocessed samples of fruits*

| Reprocessed sample | Loss (per cent) after reprocessing (removal of extraneous matter, sugars etc.) | Moisture content (per cent) | $SO_2$ p.p.m. | Remarks |
|---|---|---|---|---|
| Apricots | 2·54 | 10·45 | 1,517 | 1. Moisture content after reprocessing was about the same as in original samples |
| Figs | 2·44 | 10·07 | 1,890 | |
| Black raisins | 3·95 | .. | 640 | 2. Permitted dose of $SO_2$ is 2,000 p.p.m. for apricots and figs, and 750 p.p.m. for raisins |
| Green raisins | 11·73 | 5·33 | 750 | |
| Red raisins | 11·61 | 6·26 | 734 | |

[1] Described by Lal Singh and Girdhari Lal, Indian Farming, 1941, Vol. II, pp. 308-16.

It will be seen from this table that the percentage loss due to removal of grit, stems and other extraneous matter and sugars varies with different kinds of fruits. This loss varies from 2·44 to 3·95 per cent in apricots, figs and black raisins, but in green and red raisins, the losses are just over 11·0 per cent. This was partly due to the large amount of grit and stems in these samples and partly due to the ruptured skin of the dried fruit through which comparatively greater losses of sugars took place due to leaching. The losses of sugars, however, during 5 minutes' washing did not materially affect the quality of the product. It is also seen from Table I that $SO_2$ content of all the reprocessed samples are within the prescribed limits.

### *Reprocessing diseased fruits*

The keeping quality of any dried fruit is entirely dependent on whether the fruit has been properly sulphured or not. Analysis of the original samples under investigation showed that the fruits had not been sulphured at all, as not a trace of $SO_2$ was found in these fruits. On closer examination, it was also found that all the original samples of dried fruits were damaged by insect attack and mould rot to a varying degree, although they looked sound to the naked eye. It was, therefore, considered desirable to find out (i) the percentage of diseased fruits in the original samples and (ii) the effect of reprocessing, particularly sulphuring on the diseased fruits.

*Detection of damaged fruits :* The following methods were used for determining the extent of mould rot and insect damage.

(a) *Mould rot :* Two samples of fruits hundred in number in the case of each fruit were put in a 3·0 per cent solution of hydrogen peroxide in a deep china plate. Areas of each individual fruit affected by mould rot caused evolution of oxygen because of the catalase formed by the mould. Individual fruits damaged by mould rot could be easily seen by the appearance of gas bubbles.

(b) *Insect damage :* A number of fruits of each kind were rolled and rubbed between fingers under water placed in a deep china plate and the water examined for presence of pellets (excreta) and insects or insect parts. Rubbing should be severe enough to dislodge pellets or insects that may be present beneath the skin.

Badly attacked fruits could be detected by the naked eye or by the aid of a hand lens; for slightly attacked ones, however, a microscopic examination was necessary.

### *Extent of insect damage*

The data collected in the case of original and reprocessed samples are given in Table II. It is clearly seen that mould rot and insect damage significantly decrease in the reprocessed samples, except the insect damage in the case of apricots.

TABLE II.

*Percentage of damage in dried fruits*

| Fruit | Per cent of unsulphured fruits evolving $O_2$ in 3 per cent $H_2O_2$ | Per cent of sulphured furits evolving $O_2$ in 3 per cent $H_2O_2$ | Per cent of insect damage in unsulphured fruits | Per cent of insect damage in sulphured fruits |
|---|---|---|---|---|
| Apricots | 0 | 0 | 50 to 55 | 50 to 55 |
| Figs | 100 | 15 | 0 | 0 |
| Black raisins | 2 | 0 | 1 | 0 |
| Green raisins | 6 | 0 | 6 | 1 |
| Red raisins | 9 | 4 | 8 | 5 |

This was because the original sample of apricots had no infection of any kind on the outer surface and looked quite sound but by making open the flesh of the fruit and testing as under (b) above, it was found that 50 to 55 per cent of the fruits had insect casts and were unfit for human consumption. Original dried fruits with infection inside are beyond improvement by any known method of reprocessing. All other reprocessed samples conformed to the recognized commercial standards of purity. It is interesting to note, however, that 100 per cent dried figs as received were affected by mould rot but on reprocessing, the percentage of damage was reduced to only 15·0 per cent. In such cases the mould rot appeared to be deep seated in the flesh of the reprocessed sample where $SO_2$ fumes could not penetrate during sulphuring.

### *Recommendations*

On the basis of the experiments carried out, the following method for reprocessing is recommended.

1. Wash the fruits thoroughly but gently in

running cold water for about 5 minutes. This period of washing incorporates the desired amount of moisture in the fruit for absorption of adequate quantities of $SO_2$ during sulphuring and also involves minimum losses of sugar content.

2. Drain off the water and spread the fruit on wooden sat bottom trays.

3. Place the fruit immediately in sulphur chamber for sulphuring. Burn the required amount of sulphur as per dose already given and let the fruit be in contact with the $SO_2$ fumes for the recommended period.

4. Dehydrate the fruit after sulphuring, at a temperature of 150° to 155°F. Time taken for dehydration in a home-drier varies from 3 to 4 hours.

5. After drying, remove the remaining stems in case of raisins. Discard damaged fruits and pack the final reprocessed stuff in fairly airtight and moisture proof containers, such as friction top or soldered top tins.

The authors wish to express their thanks to Dr T.S. Sadasivan for collecting the data on diseased fruits and also to Imperial Council of Agricultural Research for the research grant under which this investigation was carried out.

## CANNED FRUIT FOR THE FORCES

The installation of the new fruit canning factory at Nassarpur, India, will mean an additional supply of 50,000 cans, or about 40 tons of fruit, per day to the fighting forces. After the war much of this production will be available for export, and we may soon see India's exotic fruit-flavours gracing foreign menus.—*Indian News and Notes.*

# What the Scientists are doing

## THE 1944 BATCH OF CO. CANES

THE eleven Co. canes which were released in February 1944 from the Imperial Sugarcane Breeding Station, Coimbatore, for trial at the various provincial testing stations are enumerated below with their percentage and general characteristics. In selecting these canes due regard has been paid to the requirements of the various cane tracts in India. Two or three of these canes are such as are rich in sucrose and fairly early in maturity. The selections also include 'general purpose' canes of the thickish type for the tropics and thin medium types for the sub-tropical belt.

*Erratum:* The parentages of the 1943 batch of Co. canes were published on page 364 of the July 1943 issue of *Indian Farming*. Since an error has been noticed in the parentage of Co.608 this opportunity is taken to correct it. For Co.231 against the parentage of Co. 608 read Co.213.

| Co. No. | Parentage | General characteristics |
|---|---|---|
| Co.612 | Co.417 × POJ.2878 | A late ripener but very good yielder. Co.419 class of cane. |
| Co.613 | Co.419 × Co.285 | A vigorous grower, selected because of good parentage and fairly heavy yield. Canes medium in thickness. |
| Co 614 | Fiji B (Badila) General Collection Likely father Co.419 | Belongs to the Co.419 class but definitely sparse in flowering. |
| Co.615 | Co.419 × B.3412 | This also belongs to the Co.419 class but is somewhat sparser in flowering. |
| Co.616 | Co.440 × POJ.2727 | A moderate yielder but rich and early in sucrose. A Co.349 class of cane. |
| Co.617 | POJ.2878 × Co.285 | A cane of Co.285 class but better in sucrose and of fairly erect habit. |
| Co.618 | POJ.2878 × Co.285 | Canes thin to medium. A good grower and a fairly heavy yielder. |
| Co.619 | POJ. 2878 × Co.312 | Belongs to the Co.312 class but with slightly better habit. Yield good but sugar about the same as Co.312 Very sparse flowerer. |
| Co.620 | POJ. 2878 × Co.313 | A Co.313 class of cane, fairly early in ripening with satisfactory sucrose. Leaves strip easily. A sparse flowerer. |
| Co.621 | Co. 421 × Co.393 | Canes thin to medium. A moderate yielder with satisfactory sucrose. Fairly early in maturity. |
| Co.622 | Co. 421 × C.331 | A fairly vigorous grower with erect habit. A heavy yielder combining in itself the good qualities of both the parents and with better sugar. |

## ADULTERATION IN GHEE

GHEE from cow and buffalo as well as from different animals of the same species differs so much in composition that it is very difficult to assess chemical purity without carrying out elaborate tests. With the coming of *vanaspati* in the market there is a great scope created for its use in the adulteration of ghee, as they are so alike in appearance that they cannot be easily distinguished. Even if a perfect test were to be devised for judging the purity of ghee what is most necessary is that it should be quick and so simple that even a layman can carry it out and judge the quality.

Recent studies carried out at the Imperial Dairy Research Institute have suggested two possible methods of detecting the adulteration of ghee with *vanaspati*. The first is that all the *vanaspati* that is sold in India should be compulsorily made to contain at least 5 per cent sesame oil. Such a low percentage of sesame oil in *vanaspati* does not affect its commercial value in any way. When even 1 per cent of such *vanaspati* containing sesame oil is added

to ghee the presence of the oil can be easily detected by the well-known test with sugar and hydrochloric acid.

Alternatively, it is suggested that all *vanaspati* should be coloured distinctively from ghee so that when the coloured *vanaspati* is mixed with ghee it will be visibly detected. It is proposed to use a dye imparting a shade of pink colour to the *vanaspati* as such *vanaspati* will not only appeal to the average consumer but will also require no external tests for its detection when mixed with ghee. When it is remembered that *vanaspati* is used only as a cooking medium this suggestion, though novel in some respects, will not in any way affect the interests of the *vanaspati* trade.

## FAT TEST FOR MILK

THE Gerber method for testing fat in milk is almost universally used in India. The method is accurate and simple. Its only drawback is that it cannot be adopted under village conditions on account of the expensive outfit which it involves. According to the standard procedure laid down centrifuging is necessary but ordinarily the purchase of such a costly machine is almost beyond the means of the small producers.

Studies carried out at the Imperial Dairy Research Institute have shown that it is possible to dispense with the use of the centrifuge under certain conditions and still obtain accurate results. This is achieved by allowing the butyrometer containing the usual reaction mixture (milk, sulphuric acid and acid alcohol) to stand at room temperature when most of the fat gets separated from the remainder of the mixture, and then holding it in a hot water-bath. For example, by allowing the reaction mixture to stand at room temperature for one-hour and then holding it in a water-bath at 190°F. for 20 minutes, the correct reading is obtained. Further, it is not necessary to take the reading at once; it can be taken after a fairly long period after the mixture has been prepared provided the same routine is followed. These modifications in the standard Gerber method enable its regular use even by small producer.

## INDIA MANUFACTURING WONDER INSECTICIDE

IT is reported it would be interesting to know that the deadly insecticide DDT (Dichloro-Diphenyl-Trichlor-Ethane) which Mr Churchill said in his war review would be used henceforward on a great scale by the Allies in the various theatres of the war, is now being made in Hyderabad at the Government Industrial Laboratory.

Under the supervision of Dr Habib Hasain, the Laboratory has so far prepared five pounds of DDT. Another 100 lb are under preparation. The cost in India of this drug, it is estimated, will be Rs. 15 to 20 per pound.

DDT is a sure drug for killing flies, bugs, mosquito larvae, common household pests such as moths, cockroaches, termites, dog fleas. DDT can also be used as a crop protector and against fruit pests. Its chief ingredients are chlorine, alcohol and sulphuric acid. It is harmless to men and animals in weak dilutions used for sprays and dusts. One of the properties of DDT is that it retains its efficacy for months.

DDT will be released for civilian use when the war is over and it is expected to revolutionize living conditions in India. The drug was discovered in 1867 by Othmer Geidler of Sweden but its properties remained unexplored till recently.

# *What would you like to know?*

*Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.*

**Q. Please tell me what are the detracting points in relation to the purity of the following breeds :—**

**1. *Sahiwal* 2. *Hariana* 3. *Murrah* and *Nili* buffaloes.**

A. 1. *Sahiwal cows :*

(i) White colour, (ii) Long legs and compact body, (iii) Tight skin.

2. *Hariana cows :*

(i) Markedly sloping rump, (ii) Loose sheath, (iii) Coarse tail, (iv) Any colour other than white or grey, (v) White hair on switch of tail, (vi) Long tail with switch nearly touching ground, (vii) Atypical horns, (viii) Big, flat, coarse prominent bulging forehead.

3. *Murrah buffaloes :*

(i) White colour, (ii) Black switch in the tail.

4. *Nili buffaloes :*

(i) Loosely curved horns, (ii) Short tail, (iii) Pink markings on the udder.

**Q. We are anxious to know what is the average cost of pasteurizing and refrigerating 100 lb. of milk. It works out to Rs. 1-9-0 i.e. ¼ anna per lb. in our dairy farm and we want to reduce it if possible.**

A. The factors which influence the cost of pasteurization are :

(a) Amount of milk handled, (b) the design, capacity and working of the pasteurizing plant, (c) the kind, amount and cost of fuel employed in heating, (d) the kind of refrigerant, the manner of employing it and the cost incurred, (e) the labour charges incurred, (f) the shrinkage or loss of milk in plant operation and (g) the extent to which technical control in economic plant operation is exercised.

Due to variations in the above factors the cost of pasteurization in different dairies varies considerably and as such a comparison of the costs can be made only with a dairy having similar conditions. The causes of variations in the different dairies have not been surveyed systematically and in the absence of such knowledge a satisfactory idea of the comparative costs cannot be obtained.

The cost of pasteurization have considerably risen everywhere at present due to the conditions created by the war and current figures have not been worked out. Some pre-war figures which have been cited in the Report of the Marketing of Milk in India and Burma (1941) (available from the Manager of Publications, Civil Lines, Delhi, at a cost of Rs. 1-4) are given below as they may be considered useful as providing a rough guide :

| | | Rs. | a. | p. |
|---|---|---|---|---|
| (a) | A private dairy, Bangalore (per md. of 80 lb.) | 0 | 10 | 3 |
| (b) | Cooperative Milk Union, Madras | 0 | 13 | 8 |
| (c) | College Dairy, Patna | 1 | 6 | 0 |
| (d) | Cooperative Milk Union, Calcutta | 0 | 11 | 0 |
| (e) | Military Dairy Farms, India | 0 | 5 | 3 |

(This Report suggests that the average cost of pasteurization may be taken at 14½ annas per md. or 1·5 pies per seer of 2 lb.)

Considering the abnormal rise in the cost of materials such as coal and other stores the cost of ¼ anna a pound of milk is reasonable.

# *What's doing in All-India*

## MADARS

By K. V. Raghavachari
*District Veterinary Officer, Erode, Madras*

During 1943-44, two cattle shows were held in the Madras Presidency under the auspices of the All-India Cattle Show Society, one at Valparai and the other at Tiruppur in Coimbatore district. The Anamalai Hills Cattle Society has been holding an annual cattle show for the past 11 years and this year—the eleventh year of the show, it was held at Valparai on November 13, 1943. The All-India Cattle Show Society donated Rs. 395 towards prize money.

The total number of entries for the show were 280. In the previous year country cattle also were shown but this year admission was restricted to only Sindhi graded animals. As many as 44 pure Sindhi stud bulls competed in the class. Very fine animals amongst graded Sindhi heifers were shown and the improvement achieved in grading up was very perceptible, some looking like true Sindhi types. Thus there seems to be an all-round improvement both in condition and quality. One remarkable feature of the show was that the bulk of the cow and heifer classes shown belonged to the *coolies* and *mistries* on the estates indicating the keen interest evinced by these poorer classes of people who have begun to realize the benefits of keeping good cattle.

The following acted as judges: Mr T. J. Hurley, Director of Veterinary Services, Madras; Mr R. C. Broadfoot, late Principal, Agricultural College, Coimbatore; Sri T. Vinayaka Mudaliar, Livestock Development Officer, Hosur Cattle Farm; Mr K. P. R. Kartha, Officer-in-charge, Animal Husbandry Bureau, Imperial Council Agricultural Research and Mr Bertie A. D'Souza, District Veterinary Officer, Coimbatore. The judges also addressed a meeting of the cattle owners on the estates and gave valuable advice to them on cattle breeding, rearing, etc. which should prove of immense value to the future development of the livestock industry in the hills.

### *The Tiruppur show*

The second show conducted at Tiruppur was on a bigger scale and was held on 5, 6 and 7 February 1944. This show was mainly organized under the auspices of the All-India Cattle Show Society, and the District Agricultural Association, Coimbatore, who were conducting their annual pony and cattle show at Tiruppur for several years, decided to have their show this year in conjunction with the All-India Show. They have contributed Rs. 500 towards the expenses of the show. This year also a very influential local cattle show committee was formed with Sri K. N. Palaniswami Gounder, Chairman, Municipal Council, Tiruppur, as the President and the Touring Veterinary Assistant Surgeon, Palladam as Secretary. The Executive Committee was formed of 13 other rich, influential and interested gentlemen of the district. The services of the Touring Veterinary Assistant Surgeon, Palladam were placed entirely at the disposal of the committee for one month for the conduct of the show. The staff of the Veterinary Department, Coimbatore, did intensive propaganda in the district, met all influential and philanthropic gentlemen for generous donations and cooperation in the conduct of the show.

The Madras Cattle Disease Act was enforced at Tiruppur from 3 to 9 February 1944. The sanitary arrangements in the show grounds were very satisfactorily attended to by the local Municipality. Adequate water supply was also provided by the Municipality. The cattle show committee made arrangements for the free supply of fodder for the various exhibits on the show days and also arranged for the supply of concentrates on payment of cost. As rinderpest was prevalent in the district, arrangements were made for the inoculation of all exhibits by the departmental officers before their enlistment for the show. The Agricultural Department, the Sericultural Department, the Veterinary Department, the Paper and Oil Manufacturing Section of the Industries Department and the S.P.C.A. Coimbatore took part in the show.

### *Kangayam breed predominant*

The show was not confined to cattle but horses, sheep and goats were also shown. The total number of exhibits competing in the show was 362. Almost all cattle exhibited were of the Kangayam breed. The opening ceremony on 2 February 1944 was largely attended by the elite of the town and district which was itself indicative of their interest in such shows. The whole day was devoted to the judging of the exhibits. The following acted as judges for the show: Mr T. J. Hurley, Director of Veterinary Services, Madras ; Sri T. Vinayaka Mudaliar, Livestock Development Officer, Hosur Cattle Farm ; Mr Bertie A. D'Souza, District Veterinary Officer, Coimbatore ; Sri S.A. Sastri, District Veterinary Officer, Madura ; Sri V. C. Vellingiri Gounder, Coimbatore ; Sri G. V. Ramaswami Naidu, Coimbatore ; the Pattagar of Palayakottai ; Sri M. A. Andamuthu Gounder of Appichimarmadam ; Sri Ponnambala Gounder ; Mr J. A. Wilson, District Forest Officer, North Coimbatore ; Mr Kearney ; Sri I. D. Mantramurthi, District Veterinary Officer, Erode, and Sri D. Pattabhiraman, Superintendent, Kangayam Cattle Improvement Scheme, Palayakottai.

There were in all 18 classes to be judged and as many as 72 prizes were given for all the classes put together. Special prizes were also given for three horses, for a calf and a pair of bullocks. Consolation prizes were given for all non-prize winners from voluntary contribution by the public for the purpose. The total amount distributed as prizes was Rs. 1,747. In addition to the above prizes challenge cups presented by rich and interested gentlemen were given for the following classes : Best horse above 14 hands ; best mare above 14 hands ; best Kangayam bull calf; best cow in the show ; best heifer calf below one year.

During the previous year three rolling cups were instituted for the best Kangayam breeding bull in the Premium Scheme, in the Government of India Grant Scheme and in the Coimbatore District Board Work Bull Scheme. In addition to the above rolling cups, a new rolling cup costing Rs. 1,000 was donated by Sri B. Rangaswami Naidu of Uppilipalayam, Coimbatore, for the best horse above 14 hands. The prizes were distributed on 7 February by Sir Hugh Hood, First Adviser to the Governor of Madras. The function was presided over by Mr T. J. Hurley, Director of Veterinary Services, Madras.

### *Anti-rinderpest precautions*

Due to the prevalance of rinderpest in the district adequate stock of anti-rinderpest serum together with the required staff for inoculation work was kept ready for use in the event of any outbreak but the health of the livestock during the show was at its best and no outbreak of any disease occurred. The District Veterinary Officers Coimbatore and Erode together with their staff spared no pains for the successful conduct of the show. The most interesting thing in connection with the show was that the public of Coimbatore district having become cattle-minded, many enthusiastic and philanthropic gentlemen cooperated wholeheartedly and contributed generously for the successful conduct of the show in the shape of prize money and silver cups. It is expected that the future shows will grow from strength to strength and become a centre of all-India attraction.

# SIND

By L. M. Hira
*Marketing Officer, Sind*

SIND is predominantly an agricultural province. It is the least industrialized of all Indian provinces. Of her present population of 45 lakhs, 36 lakhs live in villages. The population engaged in and dependent on agriculture is also about 36 lakhs. The remaining 20 per cent of the population are in trade and other professions.

### *Some facts about the province*

The area of the province is about 48,000 sq. miles of which over 10,000 sq. miles are cultivated. About 5,000 sq. miles were under cultivation even before the Sukkur Barrage was constructed. At present we have 13 lakh acres each under rice, wheat and millets, 8 lakh acres are under cotton, 4 lakh acres under

pulses and 2 lakh acres under oilseeds. About 7 lakh acres are rain-fed in Tharparkar, Dadu and Larkana districts.

There are about 70,000 land-holders holding less than 25 acres each, 45,000 holding over 25 acres but under 100 acres and 18,000 holding over 100 acres. The normal holding of a cultivator is 32 acres in non-rice areas and 8 acres in rice areas. This is the area of land that can be cultivated with one pair of bullocks. Some cultivators have more than one pair of bullocks and cultivate bigger holdings. Our cultivation is done by 70,000 small holders and 100,000 tenants.

The tenancies are annual and the rent is usually half the produce. The result is that an annual tenant is not interested in most of the improvements such as levelling the land or dividing it into small plots or manuring it when he is not sure of cultivating the same land the following year. How can he grow fruit trees, when he may be evicted from the land any year ? This sort of uncertainty makes the annual tenant indifferent even towards those items of improvement the fruits of which he could reap in one year.

The following are the latest livestock census figures : breeding bulls 17,000 ; work bullocks 600,000 ; cows 700,000 ; young stock 400,000 ; buffalo bulls 7,500 ; milch buffaloes 375,000 ; young female buffalo stock 125,000 ; sheep 650,000 ; goats 13,00,000.

### *Agricultural and horticultural prospects*

About 44,000 acres are under fruit trees in the province. Classification by trees is not available. But over half the area must be under mangoes. Citrus and dates will cover the remaining area. Area under vegetables is about 12,000 acres.

The total area we require for giving work to all the agricultural population is about 80 lakh acres. We have that much area available for cultivation today. The Lower Sind Barrage which is to be constructed immediately after the war will bring in another 15 lakh acres under cultivation.

Do we produce enough food grains for our population ? Yes. Our total requirements are 154 lakh md. of cereals every year. With our present production we can feed over 3 times our present population and therefore we need not worry for some decades about feeding our population.

Are the annual earnings of our cultivators at a satisfactory level ? No. The small holder earns a little more than the tenant. With the present prices the tenant growing cotton and wheat earns about Rs. 950 gross and the tenant growing rice only earns about Rs. 450 gross in a year. He has to pay for miscellaneous labour, repair etc. and purchase implements out of this. The average net earning of a tenant could be put at Rs. 500 a year today. This is not a very big amount. We have enough bullocks for purposes of cultivation and enough cows and buffaloes for meeting our demands for milk and milk products. Our only deficiency is in poultry. We are importing over 50,000 eggs a day.

Our total production of fruits is perhaps enough to meet the optimum requirements of the people at 2 oz. a day per head. But we do not get our fruits throughout the year. Hence the large imports of fruits from outside Sind. Also many people in villages do not get fruit to eat. We are worse off regarding vegetables. We grow only about 48 million lb. while our requirements are 400 million lb. Large quantities of vegetables are imported from outside and many thousands of people do not eat enough vegetables.

Have we reached the maximum potential in our production ? No. Let us split this question into two parts—area and yield. In area we have not reached the maximum yet. We have 80 lakhs of cultivable area of which 64 lakhs should come under cultivation each year. But we are cultivating only about 53 lakhs each year. As regards the yields the position is very unsatisfactory.

### *Problems to be tackled*

The main problem that we must tackle is the increase of earnings of the cultivator. To increase his earnings we must increase the yield from the land. This can result only from a better technique of cultivation. Better seed must be used, more manure must be put in and better implements must be utilized.

It is not perhaps always realized that improvement of agriculture in this country depends to a very large extent on three factors which are not controlled by Agricultural Department, viz. education, health and roads. It is impossible to raise our maximum potential to increase the earnings of the cultivators and to increase the agricultural wealth of the country until we have a school in every village and every child male and female attend the school. Similarly, how can we increase the earning of the cultivator when malaria or one of a host of other diseases

may confine him to bed at the most vital period of cultivation such as the time of sowing or harvesting. There must be more knowledge of sanitation and hygiene in the village, here also we come back to education again. We require more of medical facilities, many more dispensaries than we have today. We have barely a hundred dispensaries to serve a rural population of 36 lakh. Similarly it is impossible to reach every village to make medical facilities available to every one, to supervise properly all attempts at improvement unless there is a network of good roads. Nor can the cultivator get proper value for his produce until there are good roads or cheap transport to the nearest market.

### *Poultry, fruits and vegetables*

We have also a few deficiencies in production to supply. We require more poultry, more fruit trees and a large area under vegetables. Till today the Government has not been in a position to do much for the development of our poultry resources. The Department of Agriculture had no regular poultry section. We hope to have a fully organized poultry section whose main task will be the wiping out of the need for importing over 50,000 eggs a day into Sind today. The Horticultural Section is already doing a good deal for the propagation of fruit trees. This must be accelerated. Our aims are to make 100,000 fruit plants available to the public every year and also to make expert advice for plantation and care of trees available more readily to zemindars than it is today. The Department of Agriculture is paying more attention to vegetables now than it did a few years ago. We hope to strengthen the vegetable section and take vigorous action to reach the optimum production of 400 million lb.

In addition, research will be concentrated on finding a larger staple American cotton, acclimatizing Egyptian cotton, finding better yielding and more suitable strains of all cereals, manurial requirements of all crops, fruits and vegetables, the problems of water logging and the breeding of *biri* and cigarette tobacco suitable for Sind.

## HYDERABAD

By M. M. A. Rahman, G.V.Sc., I.D.D.
*Livestock Officer*

DEONI and Malvi are the two important breeds of Hyderabad (Dn.) which are being bred by professional breeders in the rural areas of the districts of Bidar and Karimnagar. These districts are fit to be excellent breed-homes by reason of their geographical position and extensive pastures. The existence of the breed-homes and the breeds have provoked the idea of introducing some such scientific method as would help the villagers to improve their cattle. Accordingly a special livestock improvement scheme was sanctioned by the Government for the breed-homes of Deoni and Malvi. Recently two Livestock Officers have been appointed to carry on the following intensive type of work in the breeding areas :

### *Improvement of cattle*

In the breeding tracts of Deoni and Malvi 218 typical Deoni cows and 87 Malvi cows have been registered up till now, with their herd-register number tattooed on their left ear. In all these villages breeding bulls have also been posted for the registered cows, and records of services are maintained by the keepers of these bulls, who are paid a subsidy of Rs. 100 per bull per annum towards the upkeep of the animal. So far, eight such bulls are posted in the Deoni area and two in the Malvi area. Demands for the further extension of this work are under consideration of the Government.

### *Veterinary first-aid centres*

To provide first-aid treatment to the village animals of the Deoni breeding area, a scheme was submitted to the Government by the Veterinary Department. To start with, six villages have been selected to be the first-aid centres. For this purpose suitable young and literate villagers have also been selected for training at the District Veterinary Hospital.

### *Silage making*

It was advocated, especially in *rabi* season, to provide succulent fodder for the village

animals in the dry season, which immediately follows the rabi crop-harvesting. This drive was initiated about a year ago and up to now it has been introduced into ten villages of the Deoni-breeding area. For demonstration, silo-pits (10 ft. × 5 ft. × 6 ft.) were dug in suitable localities of every village. Green *jowar* fodder was ensiled with sufficient pressing and packing. On the completion of filling, the fodder was covered with a layer of dry grass and rammed down with earth, sufficient to keep off the rains. After three months the pits were opened and the fodder was found to be properly ripened and succulent. The village animals, though not used to such fodder, after picking at it for some time, were found to relish it.

### *Cooperative ghee societies*

In view of the magnitude of the existing ghee industry in the breeding areas of the Bidar district, the Veterinary and Cooperative Departments have joined to work out a scheme for increasing the production of ghee. The Cooperative Department deputed a special officer to start the work, in close consultation with the livestock officer at Udgir. Accordingly the work has been started very recently and six cooperative societies have been formed to provide, on loan, a balanced ration to the producing animals and a market at the door of the producer, for his ghee.

### *A regional development scheme*

A special regional development programme has been inaugurated by the Government in Nizamsagar area, under the guidance and supervision of a board, comprising the heads of all the nation-building departments. The plan of the work includes various special activities of the Agriculture, Fisheries, and Veterinary Departments. It is about a year since the veterinary and livestock drive was initiated. The following is a brief account of the activities recorded so far.

### *Liver fluke control*

Liver fluke has been a constant menace to the cattle, sheep and goats of the area around Nizamsagar canal and its distributaries. A campaign therefore has been started against this disease under a special officer to whom the scheme provides eight assistant veterinary surgeons and twelve *kamgars* as field workers. The control plan aimed at the disease breaks the life-cycle of the fluke at two points, viz. (1) by destroying the intermediary host—the snail and (2) by killing the fluke in the liver of the animal through medication of the diseased by Igitol powder or carbon tetrachloride.

### *Destruction of snails*

This year it has been carried on to the extent given below :

(a) Mechanical removal of the snails was done in 197 villages, collecting 427 cwt. 81 lb. of snails for destruction.

(b) Chemical means of destruction by the use of copper sulphate solutions were employed in 41 villages, where mechanical collection was impossible.

(c) Biological means : The Indian Runner ducks eat the snails. Therefore effective propaganda is carried on to popularize the rearing of ducks in fluke-infested areas, which also provides a very profitable side-industry to the cultivators. The propaganda is appealing to the cultivators who are taking up the industry and are hoarding up scores of queries about it in the offices concerned.

## COCHIN

By C. S. Venkatasubba Iyer
*Entomologist*

THE first four months of the year are usually co-extensive with the period of *kole* and *punja* cultivation of paddy in Cochin. The *kole* lands, about 18,700 acres under cultivation every year, are in fact fresh water lakes drained by engine pumps during December and January. This year the cultivators, embittered by their lamentable experience of 9,000 acres of fully mature crop being submerged and completely lost in May 1943, had started their operations three to four weeks earlier than usual. The lakes have to be drained, of about six feet of water, by pumping into a net-work of canals ultimately leading to

the backwaters. Preliminary to draining, the *bunds* of the canals have to be raised above the water level and this is done by conveying soil from the highlands in boats and fixing it up by a supporting structure of bamboo posts and *cadjan* leaves, and generally the *bunds* have to be raised to an average height of two to three feet. These two operations, viz. putting up the *bunds*, and draining of water, entail about seventyfive per cent of the total expenses of cultivation. This year owing to the high costs of crude oil and other materials for the engines, and the four or five fold increase in wages, the expenditure works out to an average of Rs. 60 per acre as compared with 20 to 25 rupees in pre-war, normal times. Still every bit of *kole* land has been pressed into service earlier than the scheduled time.

The fertility of these lands is generally kept up by the deposition of silt every year during the monsoon and an inborn conviction exists among their owners that manuring of any kind is a superfluity and waste. But owing to continuous and intensive cropping the natural recuperative process does not make good the depletion effected in the soil. An intensive drive was started by the Department of Agriculture to influence and even coerce *kole* cultivators to manure the crop of this year. Fish manure, ground-nut cake and ammonium sulphate were the fertilizers advocated, and the Department had made special arrangements to stock adequate supplies of these manures in depots adjacent to the *kole* lands. Free demonstrations in the ryots' fields also were made. The Departments' efforts this season resulted in an appreciable increase in the *kole* area being manured with the above substances, and in the manured fields the crop had shown distinct improvement and profit.

### Pests on crop

The enthusiasm of some cultivators was damped in the beginning by the unexpected appearance of the stem borer (*schoenobius incertellus* wlk.) before the seedlings were two weeks old. At this stage the water in the affected fields was full of floating masses of dead moths while egg masses could be collected from each and every plant, as it were. Clipping off the tips would have removed a large percentage of these masses but the seedlings were too young and tender to withstand the mutilation. The infected fields were therefore drained of all standing water and left as dry as possible, for two or three days. Ammonium sulphate at the rate of one 100 lb. per acre was then applied and water was let in gradually and in very small quantities. These operations helped to revive the effected plants and although the central shoots had been destroyed in many cases, the seedlings were enabled to compensate the loss by increased tillering and growth. A number of affected fields were treated by the Department this January with spectacular results. In some fields instead of ammonium sulphate fish manure mixed with ashes at the rate of two cwt. per acre gave equally good results.

The Army worm (*Spodoptera mauritia* Boisd) is a pest which is usually associated with the *kole* crop, and some fields had the infection this year also. Spraying and dusting trials were carried out by the Department as in previous years. Lead arsenate and Paris green were used for the spraying and calcium arsenate for the dusting. These operations are found useful only in very small areas and are not economical on a field scale. When the pest appears, the seedlings are young and have not developed appreciable leaf surface for the spray or dust to catch on. An adhesive like flour paste is indispensable for the spray material to stick on to the leaves. Unless the plants grow thick and close together as in nurseries a large proportion of the spray falls in the interspaces between the plants and becomes a waste. Dust which catches on in the early morning gets blown off as the sun rises and the leaves get dry. The easiest and the cheapest method is to submerge the plants entirely by flooding the fields when the caterpillars float on the surface and can be gathered in baskets. Sweeping off the caterpillars is also possible, but for this the worms have to attain a size of at least half an inch, as otherwise they are too small to be tackled by the broom-stick. The Departmental officers have, as usual, afforded practical guidance to the cultivators in combating this pest.

In spite of these handicaps, the *kole* crop of this year has been generally satisfactory and will appreciably relieve the food crisis in the State.

Typical *punja* lands are low-lying areas which remain flooded from June to December, but are drained easily in the months of December and January. The water is not driven off as in the case of *kole* lands but stored in small collections amidst the fields either in canals, or tanks, to be utilized again at the later stages

of the crop. Persian wheels are used for these operations. There are a number of extensive patches of *punja* lands distributed in the central and southern parts of the State, and excepting the two operations of pumping out water by engines and the preliminary construction of bunds, the cultivation is similar to that obtaining in the *kole* lands. *Punja* is also the term used to denote the crop of paddy grown during the hot months between January and May entirely with the help of irrigation. Since the inception of the food crisis, the Government has stimulated the expansion of *punja* cultivation by systematic and vigorous tapping of all minor irrigation sources. Thus rivers and small streams have been cross-bunded at suitable points during November and December to conserve all available supplies of water. Public tanks and wells suitable for irrigation have also been pressed into service to a maximum extent. The extent of *punja* cultivation this year is much greater than in any previous year.

### *Vegetable and fruit cultivation*

Hot season vegetables, principally ash gourd, cucumbers, pumpkins, snake and bitter gourds are grown in river and *nala* margins and in gardens where well water provides irrigation. Under the 'food production drive' inaugurated by the Department of Agriculture, the areas under these vegetables have been greatly expanded this season. The Department has supplied the cultivators with large quantities of realiable and high yielding seeds, while manures have been arranged to be sold at subsidized rates. All the above vegetables show beneficial response to fish manure mixed with ashes, and the Department has conducted a number of casual demonstrations with this manure to parade before the gardeners the increased crop obtainable by its use.

The area under bananas (*musa*, big species) has also increased. Green lead, cattle dung or goats droppings and ashes are the manures commonly used for the crop but since these substances are not available in sufficient quantities, and especially so, as a result of the increased acreage, the Department has been successfully inducing gardeners to supplement them with groundnut cake, fish manure and municipal compost. The last has been demonstrated to be a very effective manure for banana plants and is in great demand amongst garden owners. Jacks and mangoes are the principal indigenous fruit trees in Cochin, and no homestead worth the name will be without a few trees of either species. The production of jack fruit during this season has been satisfactory but the mango crop is below normal. Pine-apples, the commercial cultivation of which has expanded greatly in recent years have also been satisfactory.

### *Agricultural and industrial exhibition*

Under the auspices of the National War Front, Cochin, an Agricultural and Industrial Exhibition was held at a rural development centre, Cherpu. The exhibition was opened by Sir G. T. Boag, K.C.I.E., C.S.I., C.I.E., I.C.S., Dewan of Cochin on 1 April and ran for five days, the prize distribution ceremony on the closing day, being kindly carried out by the Honourable Minister, M.R.Ry. T.K. Nayar Avergal. Representative agricultural and industrial exhibits from all parts of the State were on show and every opportunity was utilized to bring home to the visitors the necessity of scientific cultivation for 'increased food production'. One of the special attractions of the show was the row of paddy plots showing the effects of different manures. These plots had been carefully prepared and cultivated before-hand, so that at the time of the exhibition, the plants had all put forth ears, and the visitors were enabled to note distinctly the differential effects of the manures used. Preparation of common insecticides, spraying, fumigation and dusting methods were demonstrated on all days of the exhibition.

## VILLAGE MILK RECORDING SCHEMES

THE Special Committee on Milk Recording Schemes of the Imperial Council of Agricultural Research made the following recommendations at its meeting held on 14 and 15 April 1944:

1. *Object:* The objectives of a milk recording scheme are:

(i) To improve the economic position of the cattle owner by enabling him to (a) assess the economic value of his animals, (b) regulate

their feeding economically, (c) to utilize the most productive animals for breeding and to obtain a higher price for the off-spring thereof.

(ii) To improve cattle generally by providing data which will enable the selection for the widest use of those bulls which can be depended upon to produce high-yielding daughters.

2. *Scope of Milk Recording Schemes :* Milk recording should be carried out both in respect of animals of well-defined breeds and in respect of nondescript animals which are being graded up. The milk production of draught as well as milch breeds can be usefully recorded, but the emphasis which such a record gives to milk production should not be allowed to divert the attention of the breeder of draught animals from his main object of developing the draught qualities of his cattle.

3. *Selection of the area :* The area should be selected by the Deputy Director or an officer of that status, who is responsible for cattle improvement in the district in which the scheme is proposed to be worked.

The area should be compact and should consist of one village or a group of contiguous villages containing 500 to 600 breeding cows over three years of age in the case of areas of definite breeds. In the case of nondescript areas the number should be about 300.

The villagers should be willing to cooperate and the villages should be so situated that a remunerative market is assured for the milk, milk products and/or the progeny.

4. *Milk Recorder and his qualifications :* Having selected the village or villages a Milk Recorder should be appointed for each village or group of villages. He should be an intelligent conscientious man, preferably an I.D.D., conversant with the local language.

5. *Preliminary survey :* The first step which the Recorder should take is to carry out a survey of the villages and prepare a list of cows and their owners. The list should show against each cow whether she is typical of the breed or not and her reported milk yield at the peak of lactation. He should explain to the villagers in the course of the survey the objects and advantages of the scheme.

6. *Selection of cows :* Out of the list prepared the Recorder should make a provisional selection for inclusion in the scheme of the best 250 to 300 cows on the basis of conformation and such local information as may be available about milk yield. The selection should be checked and the animals finally admitted into the scheme by the Deputy Director and a representative of the Imperial Council of Agricultural Research. This is in the case of recognized breeding areas. In the case of nondescript areas all the animals will be recorded.

7. *Marking for identification :* The selected cows will then be marked for identification by tattooing of branding numbers and letters in a systematic manner. The letters used should be selected with the approval of the Council's representative to avoid two owners using the same letters.

8. *Castration of scrubs and provision of bulls :* The Deputy Director should arrange for :

(a) the castration of all the bulls in the village, and (b) the supply of the requisite number of approved bulls, preferably farm bred ones.

9. *Breeding control :* Breeding should be strictly controlled with the object of knowing which bull served which cow. Attendants should be provided for bulls in each village and provision should be made for their feeding and maintenance. Either the bulls should be kept tied up and cows brought for service or only one bull should be allowed to run with the herd at a time, whichever is found more feasible. Attendants should work under the Recorder and should report services to him every day for entry in the relevant register.

10. *Duties of Milk Recorder :* The Milk Recorder will, in respect of each selected cow, (a) record one full day's milk yield and fat percentage at least at monthly intervals; (b) record her diet on the day her milk is recorded ; (c) control breeding (vide recommendation 9) and maintain accurate breeding record ; (d) mark the progeny for identification, register them, keep contact with them and milk record them eventually ; (e) help in its sale and secure a better return to the owner.

For this purpose he should (i) give certificates of production when a lactation is complete, (ii) put purchasers in touch with records and recorded animals and explain to them the advantages of buying recorded animals, and (iii) register in Central Herd Books as soon as an animal is qualified therefor.

He should also (a) encourage owners to take part in rallies of recorded animals which he himself has organized or which have been organized

otherwise (Prizes should be awarded on the basis of performance); (b) organize the breeders into societies; (c) arrange for prevention against disease; (d) study the records and utilize them for selection of breeding stock (If necessary the advice of the Imperial Council of Agricultural Research may be sought through the Deputy Director); (e) carry on educative propaganda regarding the advantages of recording and of selecting breeding stock on the performance of their progeny and collateral relatives.

11. *Supervision:* The work should be supervised by the Deputy Director who should conduct surprise checks at least twice a year. The yield noted by him on the checking day should be entered in red ink on a Record Sheet specially provided for the purpose. A further check should be conducted by a representative of the Council at least once a year.

12. *Records required to be maintained:* The following registers should be maintained:

(a) A general register
(b) Monthly feed and milk record
(c) Service record of each bull
(d) General service records

13. *Annual Report:* An annual report should be submitted in the following form:

(i) Brief description of the area giving the agricultural condition in the year, breeds found in the area and breeding policy followed.

(ii) Number showing (a) animals on the register in the beginning of the year, (b) new admissions, (c) sales, deaths and castings, (d) services performed, (e) births, (f) castrations.

(iii) The cows in the scheme should be divided into groups, each group consisting of all the cows served by one bull. The following information should be supplied in respect of each group:

(a) Numbers in the group, (b) number that completed a lactation during the year, (c) average and standard deviation of lactation yield of milk and fat, lactation length and dry period of those mentioned in (b), (d) highest yield, (e) lowest yield, (f) average amounts of concentrates and fodder fed per day.

(iv) Data to show to what extent milk records were utilized by purchasers in selecting breeding stock.

(v) The number of bull calves of (1) recorded cows, (2) other cows purchased by Government for distribution work and the average price paid per head.

(vi) The number of (a) recorded cows, (b) their male progeny, (c) female progeny sold during the year, the price at which they were sold and a comparison with the price fetched by similar but unrecorded animals.

14. *Duration of scheme:* Each scheme should be run for a minimum period of 5 years.

15. All future schemes and schemes which have not yet started should be framed on the above lines, and existing schemes should be remodelled to conform with them as soon as possible.

## MILK RECORDING NEWS

RECORDS for lactations completed during June 1944 have been received from five village milk recording schemes. Thirty cows and 38 buffaloes completed their lactations under record, averaging 2,597 lb. for cows and 4,696 lb. for buffaloes. Records for individual breeds are given below.

### *Hariana cows*

Beri area, Rohtak district, Punjab. Twenty-one cows completed their lactations during June averaging 2,901 lb. with a maximum yield of 4,292 lb. and minimum yield of 1,890 lb. Selected records are as follows:

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| BR.151 | Takeram S/o Ranji | 7 | 23.9.43 | 272 | 3,043 | 17 |
| BH. 39 | Richhpal S/o Sehasram | 7 | 15.7.43 | 326 | 4,046 | 23 |
| DL.263 | Rama S/o Dulia | 6 | 2.8.43 | 314 | 4,298 | 21 |
| DG. 22 | Nandkishore S/o Kallu | 5 | 29.9.43 | 244 | 3,376 | 21 |
| RT. 12 | Pirthi S/o Dataram | 3 | 2.9.43 | 255 | 3,383 | 18 |
| RT. 13 | Shiblall S/o Kurria | 4 | 12.8.43 | 272 | 3,808 | 18 |

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| DR. 9 | Paire S/o Bhagmal | 7 | 1.10.43 | 259 | 3,312 | 16 |
| PL. 5 | Ramgopal S/o Shoeji | 5 | 1.10.43 | 238 | 3,690 | 16 |
| GS.120 | Ramsarup S/o Jisukh | 3 | 8.8.43 | 296 | 2,926 | 16 |

### *Kankrej*

Sanand area, Ahmedabad district, Bombay: No cow under record in this area completed her lactation during May and June 1944.

### *Local cows*

Chata area, United Provinces: Three cows of which one was a Hariana completed their lactations during June. The Hariana cow yielded 1,895 in 350 days, and the local cows yielded 1,460 and 2,349 lb. in 281 and 284 days respectively.

### *Travancore*

During May no cows under record completed her lactation. During June six cows including one (T.R.283) first grade Sindhi (half Sindhi half local) completed their lactations. The average yield was 1,881 lb. with a maximum yield of 3,695 lb. and minimum yield of 926 lb. Selected records are as under :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Date of drying | Milk yield lb. |
|---|---|---|---|---|---|
| TR.284 | Karthiyani Amma | 1 | 8.6.43 | 15.6.44 | 2,015 |
| TR.286 | Ponnan Panikar | 3 | 20.8.43 | 15.6.44 | 3,695 |
| TR.287 | Ponnan Panikar | 1 | 5.8.43 | 15.6.44 | 1,690 |
| TR.296 | K. Kunji | 2 | 20.10.43 | 8.6.44 | 1,618 |

### *Murrah Buffaloes*

Meham area, Rohtak district, Punjab: Thirty-two buffaloes completed their lactations during June 1944 averaging 4,980 lb. The maximum yield was 6,740 lb. and the minimum yield was 3,830 lb. Selected records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. |
|---|---|---|---|---|---|
| ND.218 | Udey S/o Morgha | 2 | 2.8.43 | 308 | 5,393 |
| ND.250 | Mussaddi S/o Joda | 3 | 7.6.43 | 368 | 6,740 |
| MM. 84 | Shib Lal S/o Saweeya | 4 | 5.10.43 | 360 | 5,200 |
| MM.261 | Haria S/o Laje Ram | 2 | 3.8.43 | 340 | 5,440 |
| MM.177 | Juglal S/o Junna | 3 | 15.7.43 | 341 | 5,916 |
| MM.119 | Juglal S/o Junna | 5 | 18.8.43 | 305 | 5,577 |
| MA. 5 | Gabdoo S/o Sadhan | 5 | 4.9.43 | 285 | 5,700 |
| MA. 50 | Mangtoo S/o Udey Ram | 3 | 15.9.43 | 270 | 5,820 |
| MA.259 | Bakhtawar S/o Meeaboon | 1 | 1.8.43 | 3[illegible]4 | 5,220 |
| MA.267 | Mai Ram S/o Shankaran | 2 | 20.8.43 | 289 | 6,222 |
| MA.104 | Baldeva S/o Sukhram | 8 | 1.10.43 | 288 | 5,566 |
| MA.128 | Girdhari S/o Nathoo | 6 | 20.9.43 | 252 | 5,908 |

### *Local Buffaloes*

Chata area, United Provinces : Five buffaloes completed their lactations during June averaging 3,824 lb. Maximum yield was 4,925 and the minimum 2,925. Selected records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 7 | Lekhraj | 3 | 6.7.43 | 341 | 4,206 | 9·5 |
| 308 | Chandan | 3 | 10.7.43 | 333 | 4,925 | 18·0 |
| 307 | Punni | 2 | 29.6.43 | 346 | 3,435 | 12·0 |
| 306 | Punni | 2 | 26.6.43 | 348 | 3,630 | 13·0 |

# *The Month's Clip*

## MINERAL DEFICIENCIES IN CROPS

By T. I. Williams, B.A., B.Sc.

BRITAIN'S farmers have responded nobly to wartime demands for larger and larger ploughing-up programmes and, during the last four seasons, have brought several million acres of grassland to production.

### *New curative techniques*

Such tremendous and rapid expansion has, as is only to be expected, produced many new problems. Crops have had to be introduced into districts where they were formerly never grown and where their suitability to local conditions of soil and climate was quite unknown. In the solution of these problems, agricultural scientists in Britain have played an important role. Widespread application in the field of laboratory findings has enabled farmers in Britain not only to increase their normal harvests, but, in many cases, to save crops which would otherwise have proved total failures.

It has been known for many years that, for healthy growth, plants require the presence of certain mineral constituents in the soil. Some of these are required in large amounts and are known as 'major' elements. Others, equally important for the growth of the plant, are required only in tiny quantities, and are therefore referred to as 'trace' elements. The study of these trace elements, regarded before the war as being largely of academic interest, has now been intensified and they have been shown to be vital factors in crop production.

### *Major elements in plant nutrition*

Six essential major elements are required for the growth of crops : nitrogen, phosphorus, calcium, magnesium, potassium and sulphur. Nitrogen, is a constituent of many of the most important substances occurring in plants, and compounds of nitrogen form 50 per cent of the dry matter of protoplasm, the living substance of plant cells. For this reason, the plant's nitrogen requirements are heavy and, for the production of repeated crops, frequent manuring with nitrogenous compounds is necessary. Plants growing on soil deficient in nitrogen are always characterised by an unhealthy, spindly appearance.

Phosphorus, too, is required in considerable quantities, being needed particularly in the break-down of fats, the growth of seeds and in respiration. The symptoms of phosphorus deficiency are similar to those of nitrogen deficiency. Blossoming is scanty and starts late with poor yields of grain and fruit.

One of the main functions of calcium is to form calcium pectate, of which the middle layer of the cell wall of plants is largely composed. Calcium also serves as a base for the neutralisation of acids. Symptoms of calcium deficiency are most marked in the roots which develop very poorly. The effect is particularly marked in the case of the potato, where severe deficiency may entirely prevent the formation of tubers.

Magnesium is an essential constituent of chlorophyll, the green pigment of plants. Chlorophyll is used by the plant to form nutritive sugars and starch from carbon dioxide and water. In magnesium deficiency, the green colour fades or fails to develop at all (chlorosis), and the plant becomes yellow and sickly. The leaves eventually wither and drop off and the plant is ruined for productive purposes. The effect is particularly severe in the case of fruit trees, where the loss of leaves prevents the ripening of the fruit in autumn.

Although the functions of potassium are still imperfectly understood, it is well established as an essential growth factor and deficiency causes a general stunting of growth and the production of fruit or grain is poor. In the case of green vegetables, the leaves are tough and discoloured. One of the surest ways in which the potassium content of the soil can become deficient is by the removal of hay crops year after year without suitable manuring to make good the mineral loss.

Sulphur is the last of the major essential elements. Its wide distribution in soils of all kinds makes deficiency very uncommon, and, in fact, it is unknown in Britain. In Nyasaland, however, the serious disease of tea plants known as 'tea yellow' has been attributed to deficiency of this element and can be rapidly cured by manuring with suitable sulphur-containing fertilizers.

### *Relative proportions*

Recent research has shown that, not only must these major elements be present in the soil in adequate amounts, but that their relative proportions are almost equally important. Thus, excessive dressing with potassic fertilisers can result in the plants, especially apples, being unable to utilise magnesium properly. Many of the effects of deficiency of the major elements were known before the war. Since 1939, however, they have been studied in much greater detail and particular attention has been paid to methods of applying knowledge gained in the laboratory to problems actually occurring in the field.

Iron is one of the most important of the elements required by plants—but only in tiny quantities. Deficiency is generally caused not by actual shortage of iron in the soil, but by the fact that it cannot be absorbed properly by the plant owing to a disturbance in the balance of other soil constituents. Fruit trees are the worst sufferers. The most satisfactory method yet developed for treating affected trees is to spray them with an iron-containing solution or else to inject compounds of iron into the stem.

Chlorosis is one of the common symptoms of deficiency of manganese, another of the trace elements, but detailed symptoms vary according to the crop. Oats are one of the worst sufferers and deficiency has led to many total failures. Recognition of the cause of failure, however, has made it possible to save later crops by suitable manuring. All plants are more or less sensitive to manganese deficiency, and in this condition show weak and stunted development.

### *Trace elements*

Deficiency of the trace element boron is responsible for many crop losses and here, too, recognition of the fact has made it possible to cure many diseases of plants and to grow good crops on land formerly judged unsuitable. Root crops such as sugar beet, mangolds, swedes and turnips are among the most sensitive. On soils deficient in boron, these crops develop symptoms characterised by rotting of the heart of the root, making them useless for human consumption. Brassicae, the family which includes cauliflowers, cabbages and kales, are also seriously affected. In cauliflowers the curl becomes discoloured and distorted, or fails to develop at all, and the stem becomes hollow and rotten. Cereals apparently require very little boron and deficiency is unknown in the field.

The work of these British scientists in tracking down of many diseases of plants to mineral deficiencies in the soil is in itself an important contribution to agricultural science, as a whole. Equally important, especially in time of war, is the early detection of the deficiency, preferably with a view to saving growing crops by speedy action, or at least to prevent later failures on the same ground.

Agricultural experts in Britain, in co-ordinated investigations at research institutions throughout the country, have developed a rapid visual method for the detection of simple mineral deficiencies. Many types of deficiency manifest obvious symptoms which can be immediately detected in the field by experienced observers. For example, in young sugar beet plants deficient in boron, the young leaves develop poorly, turn brown and die. At a later stage, rotting of the crown of the root sets in. In table beet, the rotting occurs on the side of the root. In some types of crop deficiency symptoms are less well marked than in others, and careful examination may fail to detect the type involved. In other cases virus infections may closely mimic the symptoms of deficiency and make diagnosis doubtful.

### *'Indicator' plants utilized*

To deal with doubtful cases of this kind, workers in Britain have developed the system of 'indicator' plants. These are plants in which the symptoms of deficiency are particularly clear cut, and by sowing these on land to be investigated, a rapid diagnosis of the kind of deficiency can be made. Another method that has been developed consists in watering crops with solutions containing different essential elements and observing which produces the most marked effect on growth. By the use of one or other of these methods it is often possible to take measures to save crops which have completed as much as half their growing period.

These advances in the field of plant nutrition in Britain have been made largely as a result of the urgent war time need to produce the largest possible crops from the limited amount of land available. In the immediate post-war years, one of the most pressing problems will be to put the food supply of the whole of Europe on a satisfactory basis. In the speedy solution of this problem these new agricultural

techniques developed in Britain will prove of the utmost value.—M.O.I.

## SCOURS IN SMALL PIGS

COMMON scours, an ailment of suckling pigs gives hog producers considerable trouble and may cause heavy losses in small pigs unless precautions are taken to prevent it. This ailment is most likely to affect winter and early spring-farrowed litters closely confined in dark, damp and chilly buildings, says H. Wilson, Dominion Experimental Farm, Lacombe, Alberta. When nursing pigs become chilled, an attack of scours is likely to result. In some instances the udder of the sow becomes affected with mastitis or garget, resulting in milk being secreted that is unhealthy for pigs. It usually causes fatal scouring. Infection from germs which are commonly associated with filth is also responsible for digestive disturbances resulting in diarrhoea and other troubles.

However, over-feeding or sudden changes in the feed of the sow are probably the most important causes of pig scours. At the first sign of scours the sow's feed should be reduced by one-half at least, and if she is receiving barley it should immediately be removed from her ration. A light, thin slop of shorts and lime-water makes the most satisfactory diet for the sow until the little pigs are better. It may be necessary to keep the sow on restricted rations for three or four days. Lime-water can be conveniently made by putting a half pound of quicklime into a pail of clean water, stirring it thoroughly while slaking is in progress and then allowing the lime to settle.

Removal of irritating substances from the bowels should be by the use of castor oil. Pigs that are less than one week old should be given a teaspoonful of castor oil, and those over a week old one tablespoonful. If the diarrhoea persists, small quantities of lime-water may be used to advantage. A tablespoonful administered to each little pig daily should be sufficient to alleviate the inflammation in the intestines. The best treatment will be of little value unless the pigs are immediately removed to clean, dry quarters.

If swine dysentery has become established in a herd, the pigs showing signs of sickness should be placed at once in another pen separate from the healthy ones. When any of the healthy group falls sick such should be removed.—*Department of Agriculture, Canada.*

## PREVENTING LOSS IN TOBACCO SEEDBEDS

SEVERAL precautions are required to avoid late, uneven, and unhealthy beds of flue-cured tobacco seedlings. Studies carried out by the Dominion Experimental Substation, Delhi, Ontario, indicate that good seed-beds can be assured by careful preparation and by watering and ventilating in accordance with the weather and condition of the plants, states F. A. Stinson, the Officer-in-charge.

A good steaming job is important. If the soil is too wet it should be permitted to dry out, or if too dry the bed may be sprinkled to advantage a few hours before it is prepared. It pays to spade the soil up, turning it over and loosening it completely to a depth of 8 to 10 in. before levelling and putting on muck in preparation for steaming. The minimum time recommended for good steaming is half an hour and even that requires a good flow of steam going into the pan. If the bed is properly prepared it need not be packed ; tightly packed soil often interferes with drainage.

Over-fertilizing is a common source of trouble. One hundred pounds of tobacco fertilizer for each 700 to 800 sq. ft. of bed is enough.

After seeding, the surface of the bed should be kept moist until the seedlings are up. Drying off during this period delays and sometimes destroys germination. After the seedlings appear in the bed, there is usually little danger of the bed becoming too dry. In sunny weather, watering once a day is generally advisable and during cloudy or damp weather at this stage, beds may be better off without watering for several days.

Ventilation from the time of seeding on should be sufficient to keep the temperature in the greenhouse below 90° F., and ventilators should be opened when the temperature goes above 80° F.

The appearance of yellow patches of seedlings, or plants rotting off above the soil should be regarded as a danger signal. Yellowing of small seedlings is usually the result of cold, wet soil, in which there is too much plant food. Loosening the muck and giving it a thorough drying out often helps in correcting this condition. When stems and leaves of seedlings in the bed are continuously wet for too long, they begin to rot off near the ground. Unless such plants are dried off, the rotting is likely to spread.—*Department of Agriculture, Canada.*

## FLOWERING OF DERRIS ELLIPTICA

DERRIS is always propagated by means of stem cuttings and very few reports of its flowering and seeding are received.

In Malaya it is said to flower, if allowed to grow for five or six years to a considerable height, 60 ft. or more, around the edge of the forests. Two supplies of seed have been received in Amani from Malaya but in both cases none germinated.

Some seed were recently received from an estate on the Central Line in Tanganyika : again none germinated.

Attempts have been made in Amani to induce flowering by various methods. Plants have been made to climb supports to a height of about 32 ft. and after six years a few flowers were produced but none set seed.

Plants on normal supports, six to eight feet high, were exposed to the light of a 300-watt electric bulb every night for a year so as to see if increased hours of light would produce flowering. No flowers resulted.

Plants left for six years on supports six to eight feet high also produced no flowers.

Some very interesting results have, however, been obtained at Amani during a sand culture experiment designed to determine the effect of shortage of various mineral constituents. Derris elliptica plants were grown in cement barrels of sand, watered with nutrient solutions, and given supports ten feet in height. The full nutrient solution used was one-half the normal strength of Hoagland's standard, and all the others were based on this.

When only two years old plants receiving only one-tenth and one-fiftieth the normal amount of calcium, but normal amounts of all other constituents, produced a few flowers which did not, however, set seed. At 2½ years considerable flowering occurred, about a quarter of them setting seed, with those plants having deficiencies of calcium, both alone and in conjunction with a deficiency of nitrogen and with a deficiency of potash. Plants deficient in calcium plus nitrogen plus potash, in nitrogen alone, in potash alone, in phosphorus alone and in nitrogen plus potash gave very few or no flowers. Plants receiving full nutrient solution gave an intermediate number of flowers. Pollination was by natural means and not induced artificially.

About 50 per cent of the seeds obtained germinated successfully.

One year later the same amount of flowering occurred on the same plants and many seeds have set, but are not yet ripe.

The indications therefore are that flowering is encouraged by lack of calcium, but it is possible that the roots having become somewhat 'pot-bound' may also play some part in the process.

Growers should be warned not to grow derris from seed, in the unlikely event of their getting any, as this might result in a general lowering of the rotenone content of their crop. Any ripe seed obtained could be sent to Amani where it would be used in trials designed to select strains with even higher rotenone content than the present 'Amani' strain.—R. R. Worsley in *The East African Agricultural Journal*, July 1940.

## LAND PREPARATION FOR FIBRE FLAX

THE special care given to preparation of land for fibre flax pays extra dividends. The choice of suitable land is of primary importance. Medium clay loam soils well drained and not too rich grow an excellent quality and yield of fibre. Flax sown on land that has been fall-ploughed out of clover or pasture sod the year previously appears to be most desirable in Ontario and Quebec. Light sand or muck soils should be avoided entirely. After careful thought has been given to the proper choice of land, the selection of an approved variety of fibre flax is essential.

The aim of the flax grower should be to produce a medium to heavy growth of straw, standing well, even in height and free from weeds. Careless choice of land sown to a poor variety on poor weedy soil at uneven rates causes no end of troubles and the flax is even more costly to handle than is a first rate crop.

It is generally conceded that sod fall-ploughed to a depth of 6 in. in Eastern Ontario and Quebec is most desirable for fibre flax. It is not advisable to manure the sod before ploughing, because this may be the source of troublesome weeds, in addition to causing the crop to grow too rapidly and rankly. Rank crops generally lodge severely and cause most difficult harvesting conditions.

At an early date in the spring a discing of the fall-ploughed sod is necessary, followed by a cross-discing, making sure that sods are not brought to the surface of the soil. Discing should be followed by a thorough harrowing in both directions to level and break down

lumps in the land, leaving the soil in a fine condition. The soil should be worked only when dry enough to break down into a fine powdery condition. Working the land 'wet' produces a rough seed-bed. Consequently germination is spotty and slow and the crop of flax is often stunted, spindly and lacking in vigour. Less vigorous flax is more susceptible to disease.

Before or during harrowing the land should be freed of stones, roots or small branches from trees. Attention to this detail prevents costly repairs to flax pullers during harvesting operations. It is often a good procedure to use a cultipacker on the land after harrowing in order to 'firm' the soil and make the seed-bed finer.

Fertilizer may be broadcast on the land in the spring and disced into the soil or it may be sown in drills with a combination grain and fertilizer drill. Too heavy an application of fertilizer in drills sometimes causes seed injury and subsequent germination reduction. From 150 to 250 lb. of a 2-10-6 per acre has given good results. Also the fertilizer may be either broadcast or drilled in previous to seeding and just after harrowing. This method requires a double coverage of the land and is therefore somewhat more costly, although it gives good results.

After the land is cultipacked, the seed may be sown either broadcast or in drills at 70 to 84 lb. to the acre and thoroughly harrowed in with a spike-toothed harrow. A second cultipacking after harrowing is desirable on soils that do not have a tendency to bake or seal over after heavy rains.

Different climatic and soil conditions in British Columbia call for a modification of the above procedures. For example fall-ploughed land is somewhat less desirable than spring-ploughed land, so that proper cultural procedures are influenced by different environmental conditions. Most farmers know their farms well enough to use modifications of standard practices to good advantage.—*Department of Agriculture, Canada.*

## RESAZURIN TEST FOR MILK

THERE are now few areas in Canada which do not have a milk supply better than was current twenty years ago. Much of this improvement can be attributed to two things; first, research which has pointed out the importance of bacterial contamination from unsterilized utensils, and second, to the development and use of simple bacteriological tests for milk quality. One of these, the methylene blue test, has been widely used in Canada by health departments and milk plants. In this test, a small amount of the dye methylene blue is added to the milk. The bacteria growing in the milk when incubated at body temperature cause the blue colour to disappear; the more bacteria present, the sooner the milk decolourizes.

One objection to the use of the methylene blue test is that as the quality of a milk supply improves, the time required to complete the test stretches to the point where it runs far beyond the ordinary working hours. Consequently there has been increasing interest in a test which would yield similar information in much less time. Such a test has been found. It makes use of a dye called resazurin, which gradually changes from the original blue shade through various shades of purple and mauve to pink and finally decolourizes. Because of this gradual change in colour, the presence of large numbers of bacteria can be detected much earlier than in the case of methylene blue. Resazurin has another advantage in its ability to reflect the presence of such 'abnormal' milks as colostrum, late lactation milk and milk from cows suffering from mastitis, thus giving a better indication of sanitary quality in the wider sense of the word.

The resazurin test, originally described on the North American continent called for incubation at body temperature for one hour, at which time milks were graded on the basis of the degree of colour change. Unfortunately, it was found that some well-cooled milks containing large numbers of dormant bacteria, showed little change in colour in one hour. To avoid this, and to permit the grading of milk supplies with greater accuracy, a modification called the 'triple reading' resazurin test was developed by workers in the Division of Bacteriology and Dairy Research, Science Service, Dominion Department of Agriculture, Ottawa. This test is being used by a number of laboratories and all who have used it report very satisfactory results. It has the advantage that it is completed within three hours, yet gives more information than would be obtainable from the methylene blue test in over eight hours. —*Department of Agriculture, Canada.*

# New Books and Reviews

## TARIFFS AND INDUSTRY

By JOHN MATTHAI, Oxford Pamphlets on Indian Affairs, No. 20. Oxford University Press 1944, (pp. 32, As. 6).

IN this pamphlet the general reader will find an admirably lucid presentation of the basic problems of tariff in relation to India's industrial development.

The first part of this essay gives us a review of the fiscal policy of the Government of India. Progress from the *laissez-faire* policy of free trade which so long kept India at the colonial stage of economic development, to the policy of limited protection, otherwise called Discriminating Protection, has been quite substantial, and India has witnessed the phenomenal growth of several important protected industries. Yet as Dr Matthai argues, the pace and direction of industrial development have been circumscribed by the absence of complete fiscal freedom. Curiously enough, the author does not discuss at all how India's fiscal autonomy has been limited by the 'economic safeguards' incorporated in the 1935 constitution. In any case Dr Matthai reflects a considerable section of Indian opinion when he says that the next stage of India's industrial development would require a national Government possessing full fiscal autonomy.

The second part of Dr Matthai's essay deals with the post-war tariff policy. Dr Matthai is not an extreme protectionist. He wants protected industrialization on rational grounds. He argues that it will secure for India a balanced economy i.e. a concurrent development of both industry and agriculture. He demands protected industrialization for promoting the habit of investment and developing the capital resources of the country, for creating the 'mental outlook associated with an industrial environment', and for raising the national income. He sees no difficulty in western industries being acclimatized to tropical conditions. He does not see why it should be difficult to find exchange necessary to finance our large export trade in agricultural products provided '*industrialization proceeds gradually and at a moderate pace*'. Dr Matthai is very far removed from the average protectionist when he says that the chief abuse of the protective policy is that industrialists are lulled into a false sense of security and do not direct their attention to the 'vital question of re-organization', or when he says that India 'cannot return a blank negative to the plea for freer international trade which is based on an expansionist outlook on trade'. But does he not seem to face a contradiction involved in the plea for protection of a big industry ? While arguing the case for industrialization he says (p. 15) that 'establishment of more industries' will provide 'alternative occupation' for the agricultural masses, thereby checking fragmentation of holding and making agriculture a business proposition. But at the same time he opines that 'it is not to be expected that an increase of industrial production will lead to a proportionate increase in employment' (p. 17). Here is a contradiction, unless 'establishment of more industries' means establishment of small and even medium-sized industries, particularly those allied to agriculture, which are distributed evenly over the rural areas and can absorb the under-employed and unemployed millions of India.

The argument that the growth of big industry will at least raise the national income and thereby 'increase the resources available to the state for financing schemes of social and economic improvement' must be qualified by an important consideration. The rise of national income through the development of big industry will not really mean much unless the rising income is fairly distributed and a substantial part of it is absorbed by the state for national development. But this will require economic controls and fiscal methods which will never be favoured by industrialists. Nevertheless, one may appreciate Dr Matthai's thesis that planless and piece-meal protection should be replaced by a co-ordinated policy of protection which is part of a post-war plan of economic development. From this point of view his opinion on the planning of post-war tariff policy merits careful consideration.

For large-scale economic development in India importation of capital goods and technical services will be of considerable magnitude. Only a part of it could be financed through the liquidation of sterling balances. A larger export trade which India will have after the war

owing to repatriation of sterling debt, 'will be absorbed and more than absorbed by payments due from her in respect of capital goods and services'. Hence Dr Matthai pleads for restricting imports of such consumers' goods 'as may be produced in sufficient quantities within the country'. But if his analysis is correct, it would also be necessary to ban imports of precious metals and to control the orgy of spending after the war which is bound to bring about a price inflation in respect of imported goods. But would it be necessary to restrict imports of goods which *may not* be produced 'in sufficient quantities within the country'? Moreover, a good deal depends upon the purchasing power of the rupee after the war.

Dr Matthai does not consider the prospects of our agricultural exports which would depend upon the prices of primary products in relation to those of industrial products after the war. He seems to think that we need not worry about the marketability of our agricultural exports. Dr Matthai prescribes high tariffs on imports of consumers' goods and advocates free trade in respect of capital goods during the initial period of economic development. He anticipates that for many years after the war existing Indian industries will not require protection till competitive trade-drive is well under way. But these industries will fortuitously enjoy heavy tariff protection owing to the exigency of importing capital goods to the exclusion of non-essential consumer's goods. They should, therefore, be able to dispense with tariff protection at the later stage of economic development. But at that stage capital goods industries, which would have outgrown the formative stage, would call for protection. Dr Matthai is sensible enough to suggest that capital goods industries should not receive tariff protection, since it will throw a heavy burden on industries in general.—B.N.G.

## THIS PAMPHLET WILL HELP GARDENERS

NO matter what precautions are taken, insect and disease outbreaks are apt to occur in certain sections of the garden and in certain crops throughout the years, according to the revised edition of the special Pamphlet, No. 45, on Control of Insects and Diseases in Vegetable Gardens. Under such conditions, the grower must resort to the use of insecticides and fungicides or other artificial methods of protecting the garden from pests. To make the most effective use of artificial control practices, the gardener should become familiar with the common insects and diseases, so that they may be quickly recognized.

In the bulletin a list is given of the names and descriptions of the insects; descriptions of the type of injury, the names of the plants attacked, control recommendations both for Eastern and Western Canada, and recommended formulae and dilution tables for the control materials. The bulletin, No. 45 (revised) may be obtained free by writing to Dominion Department of Agriculture, Ottawa.

## WORKING OF A SOIL CONSERVATION DISTRICT IN U.S.A.[1]

FIRST we want you to understand something about our district. The farms here are not what would be called large farms in this country, the average being 115 acres. On the farms of this size very few of them have the same type of soil and subsoil over the entire area. General farming is practised under which a small number of cattle are kept ; feed and pasture being grown on the farm for them. The farmer will have a garden, producing fruit and berries sufficient to supply the needs of his own family. With this background you will understand perhaps better the work of the district.

The Federal Government has set up a Soil Conservation Service providing technical assistance for soil conservation work and it also provides that the work must be carried on through local Soil Conservation Districts. These districts are organized under a state law which provides for a State Soil Conservation Committee. This committee is composed of the President of the State Agricultural College, Director of Oklahoma Experiment Station, Director of Extension Service and State Director of Vocational Education and State Supervisor of Vocational Agriculture. Any group of farmers may petition for the formation of such a district.

In the beginning we undertook to form the district on a water-shed basis. Later on we found that it would work better where it is set up on a country-wide basis because of the overlapping of other governmental agencies. If the petition is approved, the state committee calls for an election of farm owners and farm occupiers and if the vote is favourable they approve the organization. The state committee appoints two members of the Board of Supervisors, and the land owners and land occupiers elect three supervisors who will make up a board of five supervisors to govern the affairs of the district. Under the law this Board of Supervisors may call upon the United States Soil Conservation Service, the Extension Division of the Department of Agriculture, Department of Interior, State and Federal Forestry Service, State Agricultural College and other agencies for assistance in soil conservation work. They can buy fertilizers or seeds for the district but have no power to levy taxes on the district. The state provides a fund for the expense of the state committee and a small amount for the expense of operating each district.

We have found that our farm people are willing and anxious to keep the good soil and they realize that without a change in method our best soil will be washed away. We have found also that these farmers do not have the means of carrying on this kind of work unless the technical information is provided by the Government. The farmers carry on and complete the work as agreed upon with the technicians and the result has been immensely satisfactory. We have found in every case that production and income of the farmers have increased by application of proper land-use methods for every acre of the farm. These technicians will locate the spot that is best adapted for the growing of an orchard and those acres that are best adapted for other crops. They will work out the plan for rotation of various crops for the maximum production, and build up the fertility of the farm. They will look into the question of water supply for the farm and the livestock. Many of the farms have a pond to supply water to the livestock. The average pond covers two acres. We have found that by fertilizing these ponds we can grow as many pounds of fish per acre of water as the same area of grass would produce of beef, thus providing menu for the table and recreation for the children. Some of the farms arrange for irrigation for a small garden spot below these ponds.

The Soil Conservation Districts have endeavoured to interest other agencies in this work in order that we might make greater progress in covering the entire territory. Among other agencies we have found bankers were very much interested in soil conservation and increased production and they readily cooperated in furthering the programme. They are presenting to the operator of each farm that complies with the programme a 'Certificate of Award'

[1] F. S. Hurd, Chairman, Board of Supervisors, Arkansas Verdigris Soil Conservation District in reply to a letter addressed by the Secretary, Imperial Council of Agricultural Research, requesting information about the working of a Soil Conservation District in U.S.A.

nicely framed. For the presentation of these certificates they hold a meeting of the farmers and land owners who are interested in farming and put up an educational programme with this presentation. Farmers who have received this Certificate of Award appreciate it very highly and it is a source of interest to other farmers and an incentive to complete their own programme so that they may also receive one of these certificates.

## RECLAMATION OF ALKALINE SOILS

AGRICULTURE has been my hobby for a long time. I have zealously taken to improved methods of agriculture as advocated by the Agricultural Department and I am glad to say that I am amply repaid by following their advice. I record below my experiences in improved methods of farming, particularly reclamation of alkaline soils, so that it may be of help and encouragement to my brother agriculturists.

I have a block of land of five acres which was highly alkaline and bore no crops owing to the presence of excess salts at the top layer. The drainage also was very defective owing to the clayey nature of the soil. Various methods are advocated for the reclamation of such soils. They are:

(i) Leaching with proper under-drainage or improving the drainage by incorporation of organic matter.

(ii) Scraping and removing the top alkali incrustation.

(iii) Flushing.

(iv) Correction by the incorporation of gypsum.

Of the above methods, application of gypsum is not so easy as suggested because it can be had only in very few localities. Flushing consists of flooding the field and allowing the water to run out with the excess salts. This can be done during the heavy rainfall or when water is available near at hand. But the effect is only temporary as salts may rise up again to the top layer with the evaporation of soil moisture. Scraping of top alkaline crustation and its removal may prove helpful in the long run. But the first method of improving the drainage by the incorporation of organic matter and allowing the salts to be washed down was found to be the best and it proved a great success.

The kind of organic matter to be incorporated may vary. Some ryots are in the habit of ploughing in palmyra leaves (*Borassus flabellifer*) or *varagu* straw which is not eaten by cattle and tamarind seeds and husk. But I applied groundnut husk at the rate of 15 to 20 cartloads per acre with better results. Trenches 2 ft. wide and 2 ft. deep at a distance of 100 ft. in parallel lines were also dug leading the drainage water to fall into a bigger channel. Application of groundnut husk opened up the soil ana the digging of trenches further facilitated drainage and produced the leaching effect. The concentration of salts at the top was thereby reduced and crops began to grow well. The application of groundnut husk was continued for five years. But now owing to the shortage of fuel groundnut husk has become dear and the cost of transport is also high. So I have taken to green manuring i.e. the growing of *daincha* (*Sesbania grandiflora*) *in situ* and puddling it in and this has given good results.

Hence as a result of the application of large amount of organic matter and improvement of the drainage the alkaline lands were reclaimed and I am now raising good paddy crops yielding 3,000 lb. of grain per acre where formerly I could get nothing.—SRI Y. S. VENKATRAMANA AYYAR, *Retired Pleader and Landlord, Tirupattur.*

## FIGHTER ON THE FOOD FRONT

RAO SAHIB Sri G. Rajagopal Pillai, President, District Agricultural Association, Trichinopoly and a leading *mirasdar* of Lalgudi *taluka* raised on the advice of the agricultural department 25 acres of third crop paddy in double crop wet lands for the first time in his home farm at Bikshandarkovil. This gave an impetus to the neighbouring villagers who copied his example and brought 150 acres under the third crop during the year 1942-43. This extension of area was made possible by the cooperation of the Public Works Department in shortening the closure period of the channel from 30 days to 15 days which provided sufficient supply of water for the third crop.

Rao Sahib grew the departmental paddy strains of ADT.3, ADT.16, ADT.19, ADT.11, Co.15 and G.E.B.24 in about 100 acres and this increased the normal production of paddy by 10 per cent. He also raised five acres of paddy seed in 1942-43 and 35 acres in 1943-44

and supplied 150 bags of pure seeds to the Agricultural Department for distribution. He raised and distributed free to the Department and ryots 1,200 green leaf tree seedlings and 10,000 seeds for planting during the Tree Planting Day. As President of the Dist ict Agricultural Association he purchased and distributed 100 Tata spades at a cheap price of Rs. 1-12 each.

His work in connection with 'Grow More Fruits' was very valuable. He organized the First Tamil Nad Fruit show at Trichinopoly during December 1943 and the Show was very successful due to the personal interest taken by him. This gave an impetus to the 'Grow More Fruit' campaign.—P. H. RAMA REDDI, C.I.E., I.A.S., *Director of Agriculture, Madras.*

## DID YOU EVER WONDER

SEVERAL years ago Charles Peacock, a Colorado farmer, hit upon a new tillage method which he claims is effective in conserving moisture and in checking wind erosion of his cultivated fields.

His idea is to use a modification of the lister method of plowing. A lister is a sulky plow having a double mold board which turns the furrow in both directions. Immediately behind the plow is a subsoiler for making the furrow deep enough to reach the moist soil below.

The lister method is designated for use in the more arid regions of the Corn Belt. Its advantages include the ease with which weeds can be destroyed and the tendency of the corn to stand well because of the deep planting. It is not recommended for areas subject to heavy rains, since the deep, continuous furrows provide ready made gullies for wind and water erosion.

Mr Peacock, however, has made certain changes in the tilling equipment with the result that the continuous furrow is broken up into a series of consecutive short troughs or compartments. This is accomplished by means of a system of blades which follow behind the lister-type plow and scrape the loosened earth up into small dams at frequent regular intervals.

These dams form little pockets in the field in which the young plants are sheltered from the strong winds. At the same time, the checker board of pockets forms a network if miniature reservoirs, which conserve moisture by preventing run-off, and serve as both wind and water erosion controls.

According to reports, Mr Peacock has found his novel tillage system of real practical value, having raised, harvested and marketed several excellent crops since the practice was instituted on his farm.

The proceeds of the sale of these crops enabled him to pay off the indebtedness incurred earlier when, under ordinary farming methods, high winds and rainfall deficiency consistently played hob with his newly planted crops.

### ERRATUM

INDIAN FARMING, Vol. V., No. 7, July 1944, p. 340, line 4 —

*for* 'To be Knight Companions'

*read* only 'To be Companions'

# INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V : No. 10
OCTOBER 1944

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# INDIAN FARMING

ISSUED BY

THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. V OCTOBER 1944 No. 10


## AGRICULTURAL STATISTICS

A good deal has been said and written about the deficiencies of agricultural statistics in India both of areas under crops and of yields, and on the urgent need of improving them. Statistics of area are the foundation on which the estimates of yield have to rest; but they are admittedly unreliable for the permanently settled parts of the British India, and are completely lacking for about 44 per cent of the total area covered by Indian states. As for the yield, the methods of estimation in vogue are known to be faulty and it is difficult to say what reliance can be put on its estimates.

The absence of an elaborate revenue organization is the chief reason for the deficiencies of area statistics in permanently settled areas. There can be no short-cut for improving the position in this respect without appointing the requisite staff, but it is no easy matter to find staff on the scale required at the present time. Nevertheless, the Government of Orissa, with assistance from the Government of India, have already taken in hand a scheme for field to field enumeration designed to give accurate record of acreage statistics under different crops. The results for the current year are expected to be available by February 1945. The Government of Bihar and Bengal too have taken the decision to set up machinery for field to field enumeration of the different crops.

The difficulties of estimating yields of crops, whose areas are known, are primarily those of method. Yield per acre is the product of two factors: (1) the normal or the standard outturn and (2) the condition or the anna estimate. The normal outturn is defined as the outturn of an acre of land of average quality averaged out over a number of years. The condition estimate is a subjective estimate of the crop in terms of the normal. In practice, the normal outturn is interpreted differently by different people. If the 'normal' conveyed the same meaning to all, then over a series of years the average of the condition estimate would be equal to the anna figure for the normal. This, however, is not so. The *patwari* seems to regard the normal outturn as the yield obtained in a good season from land of a fair quality. He thus compares the standing crop with something approaching the full crop, when he reports on its condition. A district officer may or may not attach the same meaning to normal outturn. He may regard normal yield as the yield on average soil in an average season and fix it accordingly by conducting crop-cutting experiments on land of average quality. In this case it is certain that the yield is underestimated by the extent to which the anna figure for normal may exceed the average of the anna factor over a series of years. On the other hand, a district officer who puts himself in the position of a *patwari* may revise his idea of a normal and suitably revise the figure for normal yield. It has been found, however, as a result of investigation that there is no consistency in the *patwari's* method of reporting on conditions factor and there is no uniformity in the procedure of fixing a normal.

The only alternative approach is to conduct crop-cutting experiments in such a way as to obtain an unbiased estimate of the average yield per acre. Under the existing system these experiments are conducted along defective lines. Their major defect is the absence of an objective procedure in the choice of representative sites. This choice is left to the agricultural officers and the revenue inspector who do these experiments. The revenue inspector looks upon these experiments principally as a sort of guide for determining either the extent

of remission of land revenue in bad years or the relative values to be given to different soils in settlement years. The choice being thus intended as an aid to executive action, gives a biased character to the outturn and vitiates the forecast of the crop. In experiments intended to secure an unbiased estimate of yield, there can be no justification for leaving the selection of fields to the personal vagaries of the staff. The selection has to be so made as to give every field an equal chance of being sampled. The second defect concerns the number of experiments, which is necessarily small under present conditions and must be increased in order to obtain a reliable estimate of yield. Further, the number of experiments has to be so distributed over the district as to secure an estimate of yield of maximum accuracy.

A method free from these defects has been evolved as a result of a series of researches under the auspices of the Imperial Council of Agricultural Research. It is based on the well-known principle of random stratified sampling. Its application on a province-wide scale in respect of wheat has shown that it is adequate for the purpose of forming reliable estimates of yield. Thus, by sampling 100 acres out of a total of 9 million acres under wheat, the net outturn of the crop for the Punjab was estimated with a sampling error only just over 1 per cent. The work was carried out with the help of the staff of the Department of Agriculture. The cost of the work hardly exceeded Rs. 1,000 per district. The following extract from *Nature* will illustrate the technique of the survey.

'Uniformity of practice was obtained by central training of the senior staff concerned in all the details of the experiment, and also by central selection of the 748 villages (about 2 per cent of the total number available) used for the scheme. These were, for each district of the province, proportionate in number to the area under wheat, but equally distributed amongst the *tehsils* of the district, and randomly within each *tehsil*. Within each village three fields were selected (since previous experimentation had shown little difference between the variation between villages and that between the fields of a village, and practical considerations of time, labour and cost counselled concentration of fields within a village), and within each field one plot of 1-20th acre (the variation between plots in a field being less than that attributable to either source just mentioned). Selection of the fields in villages and of the plot in each field was by use of random numbers supplied by the centre, which was able to check the process. Harvesting, threshing, winnowing and weighing were normally completed in one day. The final estimate includes adjustments for 'driage', owing to the divergence of this procedure, necessary for accuracy and speed, from the general practice which allows a week or two for drying between harvest and threshing, and also for the different yields of wheat sown pure or mixed with other crops.'

The surveys carried out during the last season in the Punjab and the United Provinces are the first large-scale surveys of their magnitude to be attempted in this or any other country. Their extension to other principal food grain crops in all provinces, where area statistics are known, is already in the hands of the Central Government. The importance of the work to this country and outside can hardly be over-stated, especially under the peculiar conditions of today when the statistics of production have a fundamental bearing on the shaping of agricultural and food policy of a country. It is to be hoped that the work will be conducted over a period of years until reliable estimates of normal yields are available for each crop in each district and that in course of time it will become a permanent feature of the work of the Departments of Agriculture in the provinces.

# Dr Sam Higginbottom

## An Appreciation

SAM HIGGINBOTTOM, founder and principal of the Allahabad Agricultural Institute, Allahabad, U.P., retires in October at the age of 70 after over 41 years of service to India. Immediately after he arrived in Allahabad in 1903, to teach economics in the Allahabad (now Ewing) Christian College as a missionary of the Presbyterian

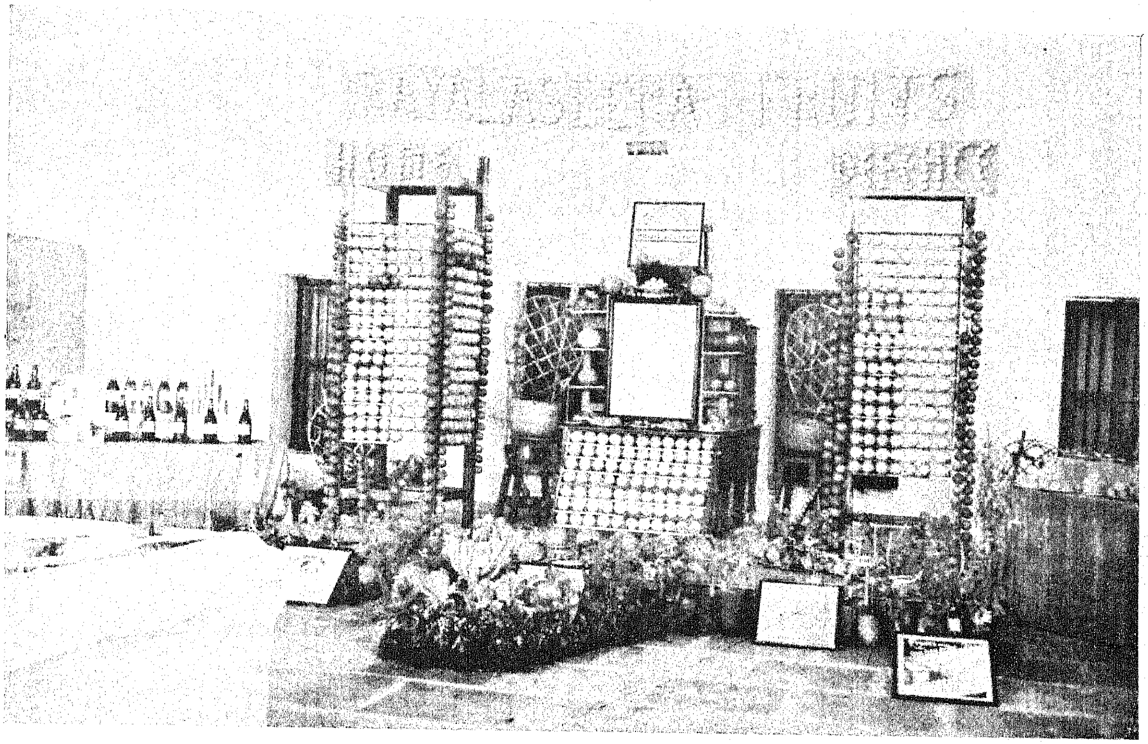
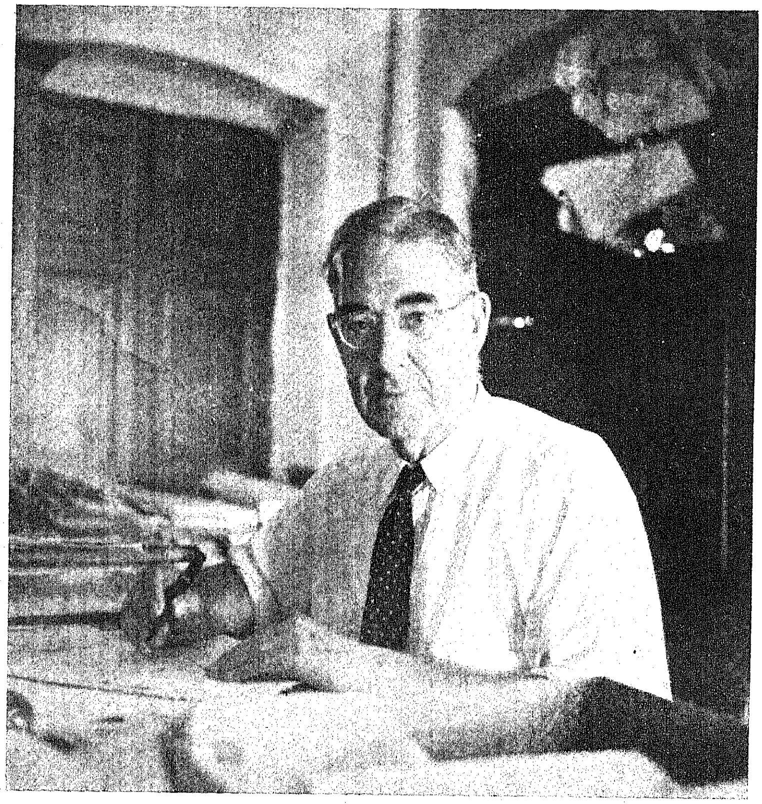


FIG. Government stall in the Fruit Show, Madras

[ See page 476 ]

PLATE 43



Dr Sam Higginbottom

[ *Photo by Sumati Bolar* ]

PLATE 44

Church in the U.S.A., he realized that the remedy for India's hunger and poverty was larger farm crops and that her economic problems had their roots in agriculture. His sympathy and desire to help in the most effective way led to his determination to start the teaching of scientific agriculture. The Department of Agriculture of the college with which he was associated came into existence in 1910. Meanwhile Dr Higginbottom returned to America to take the B.Sc. degree in Agriculture at the Ohio State University in 1911. In 1912 this Department was moved to its present site just across the Jumna river south of Allahabad and it became the Allahabad Agricultural Institute in 1918.

Since that small beginning the Allahabad Agricultural Institute has grown until it now has a farm of 600 acres. It includes about 20 acres of orchards ; a dairy handling over 4 lakh pounds of milk a year; a herd of about 450 heads of cattle besides several hundred heads of sheep, goats, poultry and swine ; a farm machinery workshop which manufactures thousands of farm implements each year ; and a college of agriculture in which courses in animal husbandry and dairying, home economics, agriculture and agricultural engineering are given to the diploma, intermediate and bachelor of science degree standards. About 180 students are enrolled annually; over 700 have already completed their training. Students have been admitted from all provinces of British India and from many of the Indian states. Several have come from other countries, such as Iran, Malaya, Egypt, and the Fiji Islands. The staff consists of 30 persons assigned to eight different academic departments. Many of them spend a portion of their time in research and extensive work and frequently assist different Governments in an advisory capacity.

Dr Higginbottom has made his contribution not merely through the Institute he founded at Allahabad. Throughout his career he has been called upon frequently to give special advice to Indian states, Government agencies and Universities. In 1915 and 1916 he drew up plans for the Department of Agriculture in Gwalior State and during the next three years organized and established that work. Again in 1936, together with Col. F. L. Brayne and others, he made a rural development survey of Gwalior at the request of His Highness the Maharaja. At the request of the late Sir James Roberts, at one time surgeon to Lord Hardinge, Dr Higginbottom surveyed several of the Rajputana and Central India States, from 1913 onwards, and advised them on agricultural matters. Some of the States visited in that connection were Bikaner, Jodhpur, Indore, Ratlam, Dewas Sr., Dewas Jr., Jasra, Dholpur and Datia. The Prime Minister of Benares called upon him to advise and assist that State in developing its agricultural work. He visited Balrampur, Baroda, Rewa, Maihar, Kolhapur, Dhar and others at the request of officials in those States and found it necessary, because of other duties, to decline invitations to visit many others.

He was invited to serve as a co-opted member of the Royal Commission on Agriculture during its work in the Punjab ; at that time he was the personal guest of Sir Ganga Ram who maintained a private coach while on tour as a member of that Commission. From 1912 onwards he was an unofficial member of the Board of Agriculture, Government of India, either as a representative of Gwalior State or of the Allahabad Agricultural Institute. He was repeatedly asked to serve on different committees of the Government of India as well as that of the United Provinces. In 1916 he was invited to give an address at the opening of the Central Hindu University at Benares in which he was to present the case of agriculture as a university subject. He served from time to time on various bodies or committees of the University of Allahabad, Agra University, Benares Hindu University and the Muslim University at Aligarh. There were invitations to be of similar service to others. He was Honorary Superintendent of the Naini Leper Home and Hospital for 33 years.

At least two Viceroys, Lord Irwin and Lord Willingdon, visited him at Allahabad during their tenure of office. Lord Linlithgow visited the Allahabad Agricultural Institute as Chairman of the Royal Commission on Agriculture. Dr Higginbottom was recently a guest of Lord Wavell. Nearly every Governor of the United Provinces from the time of the founding of the Institute at Allahabad has visited Dr Higginbottom and the Institute, some of them several times in one year, to seek his advice and to offer their help. He was invited to advise Mahatma Gandhi on at least one occasion and was frequently consulted otherwise whenever he and Gandhiji met.

Dr Higginbottom was born in Wales. He took his B.A. at Mount Hermon School at Northfield, Massachusetts, U.S.A., his B.Sc. in Agriculture at the Ohio State University and

his M.A. at Princeton University. He has been honoured both in India and America. From the Government of India he has received the Kaiser-i-Hind Gold Medal and a bar, the King George Silver Jubilee Medal and the Coronation Medal of George VI. In the United States he was given the Master of Science and the Doctor of Humane Letters degrees by Amherst College, the Doctor of Philanthropy degree by Princeton University, and the Doctor of Laws degree by Western Reserve University. In 1939 he was elected Moderator of the General Assembly of the Presbyterian Church in the U.S.A., considered the highest honour it is possible for his church to give him.

Mrs Higginbottom has shared the vision and will to serve India which Dr Higginbottom had. Apart from family duties, she supervised the babies and the older boys and girls born to leper parents at the Naini Leper Home and Hospital during the years Dr Higginbottom was associated with it. She was ceaseless in her efforts to provide medical help to village women. The present Department of Home Economics of the Allahabad Agricultural Institute, where home economics is taught to the intermediate standard, was a result of her planning in fulfilling a desire to improve the Indian home by teaching girls to become better home-makers. She was decorated by the Government of India with the Silver Kaiser-i-Hind Medal and a bar, and was given the honorary degree Doctor of Humane Letters by Western College for Women in Cleveland, Ohio, U.S.A.

Whatever good he may have accomplished during his years in India, Dr Higginbottom states, is in fulfilment of the command to 'Feed my sheep'. India can express her appreciation in no finer way than to say, 'well done, good and faithful servant'.—J.N.W.

## AN IMPORTANT FINDING

DR B. B. Mundkur, of the Imperial Agricultural Research Institute, New Delhi, writes to us pointing out an error in the leading article of our June number, entitled 'Concerning Mycologists'. He refers to the paragraph 'In 1937, while on a visit to India, Professor A. H. R. Buller, a distinguished English Mycologist.........pointed out that the basidio-spores formed by the Karnal bunt fungus were much more numerous, and behaved in a different manner after formation, from those of the European bunt, and rightly pointed out that it belonged to a different genus'. Dr Mundkur writes 'It was I who brought this matter, that of the formation of numerous sporidia by the Karnal Bunt, to Dr Buller's notice and requested him to confirm if my belief that the fungus is *Neovossia* was correct. He completely agreed with me and in justice to him, I must point out that it was he who brought to my notice the figures etc. in Brefeld's Untersuchungen, Vol. 12, p. 170, plate 10.'

We are grateful to Dr Mundkur for pointing out the error, and are glad to learn of the prominent part played in this important finding by a distinguished Indian Mycologist.

# *Original Articles*

# IMPROVEMENT IN THE YIELD OF PADDY

By V. G. Vaidya, B.Ag., Ph.D.(Bristol)

*Deputy Director of Agriculture, Eastern Circle, Raipur*

RICE is by far the most important food crop in the Central Provinces and Berar, occupying over 57 lakhs of acres out of about 247 lakhs under cultivation. The provincial output of cleaned rice amounts to a little over 16·2 lakh tons of which 1·7 lakhs are exported. The imports are negligible amounting to only 4,400 tons, showing that the province is a surplus province so far as rice is concerned. It is an important cash crop in the Chhatisgarh division where about 80 per cent of the rice area is concentrated and hence the attention of the Agriculture Department, since its organization in 1906 was engaged in the improvement of its yield and quality. The need has, however, been felt more keenly in the present times due to fall of Burma which deprived India of about 15 lakh tons of rice.

### *The rice area in the C.P.*

The rice area in the province is roughly divided into two parts, viz :

(a) Wainganga Valley comprising Chanda, Bhandara and Balaghat districts and Seoni *tehsil* of Chhindwara district.

(b) The great inland basin of old Chhatisgarh division comprising Raipur, Bilaspur and Drug districts.

In the Wainganga Valley, with 14·3 lakh acres under rice, about 70 per cent of the area is transplanted while in Chhatisgarh, with 36·0 lakh acres, hardly 1 per cent of the area is transplanted, and even this small area is confined to tracts bordering on the districts where transplantation is already in vogue. The rest of the area is *biasied*, i.e. where paddy is sown broadcast with a seed rate of about 100 lb. per acre and subsequently ploughed and cross-ploughed to thin out the seedlings when they are about 6 to 9 in. high. Trials conducted on Government Experimental Farm, Labhandi, Raipur, from 1906 onwards showed conclusively that transplantation gave an increased out-turn of about 500 lb. of paddy per acre. The earlier workers could not satisfactorily account for this important difference in agricultural practice between these two tracts, which are situated at no very great distance from each other and between which there is a good deal of inter-communication. The three districts of Chhatisgarh were regarded as the most backward agricultural tract in the province and the Chhatisgarhi was recognized as one of the laziest and the least enterprising of cultivators. The earlier workers, therefore, having convinced themselves of the superiority of transplantation, regarded this as the best and most effective way of improving the yield of paddy. A vigorous propaganda was carried on to educate cultivators in the method of transplantation. Many facilities were extended, inducements were offered and in some cases even moderate pressure was exercised for the rapid spread of transplantation which was then calculated to increase the yield of the farming community of Chhatisgarh by nearly Rs. 4 crores annually.[1]

### *Transplantation*

Unfortunately these efforts did not bear the fruits anticipated and though transplantation increased from 68·4 to 71 per cent in the Wainganga Valley, it expanded from 1·3 to 1.4 per cent only in Chhatisgarh during 1906–1923. The factors operating against the general adoption of this useful practice were to be found in certain economic and physical conditions of the tract and not so much with the Chhatisgarhis themselves. These have been brought out by Moharikar[2] and Allan[3] and are summarized below :

1. *Absence of assured irrigation:* Transplantation delays ripening by a couple of weeks or so and in the absence of assured irrigation facilities, a condition far from universal in

[1] D. Clouston, 'The Transplanting of rice in Chhatisgarh'. *Agricultural Journal of India* Vol. III, part IV. pp. 339. (1908).

[2] Annual Reports on the demonstration work carried out in the Eastern Circle, Raipur, C.P. 1923–1942.

[3] Allan. R.G., *A consolidated record of field experiments*, 1906–1930.

Chhatisgarh *biasi* is safer. Out of the total area under paddy in Wainganga Valley 45 per cent was irrigated while in Chhatisgarh only 8 per cent was under irrigation in 1923. Even in 1943 with rapid advancement in irrigation only 17 per cent of the paddy area is protected. Transplantation is, therefore, to be found on areas protected by a tank but could not be followed elsewhere.

2. *Non-existence of a seedling area :* Transplantation demands the existence of a seedling area protected from grazing and the transport of seedlings to the field. Where holdings are of a fair size and reasonably consolidated this provides no difficulty but in an area like Chhatisgarh where fragmentation is intense conditions militate against its popularity. A *malguzar* with his fields in some measure consolidated may be induced to transplant but for the cultivator whose fields are to be found in perhaps 20 isolated blocks there is the inducement to adopt the practice. Consolidation of holdings is, therefore, a necessary precedent to transplantation and unless it is achieved in a fair degree transplantation cannot be undertaken.

3. *Want of strong cattle :* This is also one of the important reasons for the prevalence of *biasi*. The rice area per pair of cattle in Wainganga Valley averages to 3·7 acres while in Chhatisgarh it averages to 5·9 acres. In fact, it comes to 11·8 acres per pair when it is realized that two pairs of weak and small sized animals generally available in Chhatisgarh are required to do as much work as one strong pair in the Wainganga Valley. A pair of cattle is necessary for transplanting 5 acres and as such the population of plough cattle falls short in this tract.

4. *Limited time for operation :* Transplantation on any wide scale makes a very heavy demand on labour over a short period, i.e. from 15 June to 31 July of which a week is utilized for sowing, a fortnight for ploughing and the rest of the period for transplanting. In fact, it postulates a considerable density of population to permit any wide application. In many parts of Chhatisgarh the population is by no means dense and the absence of sufficient casual female labour renders impossible the common adoption of this practice. A Chhatisgarhi, therefore, follows *biasi* to carry out sowing from 15 May to 15 July and *biasi* from 1 July to 15 August and thus spreads his work over a longer period and manages it with the available labour.

5. *Intensive cultivation postulates high priced land :* It also assumes the existence of a high standard of living. Neither of these operate over a large part of the rice tract. In their absence a more extensive system is in all probability sounder especially when under the first reason it may be safer also.

As the outcome of operation of one or other and indeed at times several of these factors together the application of this assured method of increasing yields has made progress only in certain tracts and that too to a limited extent. It has shown vividly that application of agricultural research is subject to limitations imposed by the economic and physical conditions prevailing in a tract. This line of propaganda had, therefore, to be given up in Chhatisgarh and other factors affecting the yield of paddy were taken up from 1923.

### *Research work 1923/1943*

Having been convinced that *biasi* has come to stay, research work was directed to such problems as evolution of higher yielding strains, eradication of wild rice, locally known as *karga*, which is an attendant evil of *biasi* cultivation, manurial requirements and other cultural problems affecting the growth and yield of paddy. Some of the promising early selections and hybrids evolved by the Second Economic Botanist during 1923-33 were E.B.17, Surmatia, Bhondu, Bhondu × Parewa, Hardigabh, Luchai, Gurmatia and Fine Chinoor. Of these Luchai, Gurmatia, Surmatia and Bhondu × Parewa were the most popular, the first two having the greatest demand in the market and the last two being very useful for the eradication of *karga*. The experiments conducted on Government farms, private demonstration plots and on cultivators' fields showed that these improved strains gave as much as 10 to 25 per cent higher yield than the older varieties. This line of work was taken up independently by the Rice Research Scheme financed by the Imperial Council of Agricultural Research from 1933. As a result of eight years of research work some excellent selections from existing varieties and hybrids of great value in eradication of *karga* have been evolved[1]. Some of the results of economic value are summarized below :

1. *Production of improved strains :* Out of a collection of nearly 700 varieties grown in the province the following high yielding strains of

[1] Annual Reports of the Rice Research Scheme, C.P., Raipur, 1934-1942.

ordinary and fine scented rice have been evolved to suit the varying requirements of the different rice districts. They have been found to give 10 to 25 per cent higher yield than the old standard varieties at Raipur and other centres of the rice tract.

TABLE I

IMPROVED RICE STRAINS IN THE CENTRAL PROVINCES

| Strains | Time of ripening (Sowing time – middle of June) | Yield in lb. at Raipur (average 1937-1941) |
|---|---|---|
| *Ordinary varieties – Early* | | |
| *R2 Nungi (No.17) | October 3rd week | 1,304 |
| *R3 Sultugurmatia | October 4th week | 1,630 |
| *Medium* | | |
| R4 Surmatia | November 1st week | 1,501 |
| R5 Ludko | November 2nd week | 1,636 |
| *Late* | | |
| *R6 Budhiabako | November 3rd week | 1,618 |
| R7 Ajan | -do- | 1,872 |
| Gurmatia | -do- | 1,471 |
| *R8 Benisar | November 4th week | 1,808 |
| *R8 Luchai | -do- | 1,678 |
| *Fine scented rice – Medium* | | |
| *R10 Chhatri | November 1st week | 1,247 |
| R11 Dubraj | November 2nd week | 1,378 |
| *R12 Banspatri | -do- | 1,501 |
| *Late* | | |
| R13 Kubrimohar | November 3rd week | 1,581 |
| R14 Badshahbhog | November 4th week | 1,403 |
| *Very late* | | |
| *R15 Chinoor | December 1st week | 1,569 |

*N.B.* All the above varieties are suitable for Chhatisgarh. Those that are marked * are recommended for Wainganga Valley.

2. *Wild rice problem :* It is a problem specific to Chhatisgarh. The incidence of this weed in *biasi* fields was studied in detail by Dave[1] and was found to vary from 3 to 30 per cent causing an estimated loss of more than Rs. 22 lakhs. It is a weed which closely resembles the cultivated varieties and cannot be weeded out during the period of its vegetative growth. It can be distinguished only when the ears are formed, and on account of its characteristic of shedding grain completely long before cultivated rice matures, it gets self-sown and multiplied year after year. It has now been possible to prevent the above loss by the use of the following three high yielding purple-leaved hybrids and three hybrids with dark purple auricles. The combination of high yield of the green parents like Luchai, Bhondu, etc., and the purple colour of leaves and stem of the other parent, Nagkesar, or the dark purple auricles of Parewa has enabled cultivators to distinguish *karga* in the seedling stage and eradicate it and at the same time obtain nearly as high yield as is given by the green parents.

[1] Dave B.B. 'The wild rice problem in the Central Provinces and its solution', *Indian Journal of Agricultural Science*, Vol. XII Part I. (1943).

TABLE II

| Hybirds | Time of ripening (sowing time – middle of June) | Yield per acre (lb.) |
|---|---|---|
| *Purple-leaved hybrids* | | |
| *Early* | | |
| Cross No. 1 (No. 17 × Nagkesar) | October 3rd week | 1,112 |
| *Medium* | | |
| Cross No. 2 (Bhondu × Nagkesar) | November 2nd week | 1,439 |
| *Late* | | |
| Cross No. 5 (Luchai × Nagkesar) | November 4th week | 1,552 |
| *Hybrids with dark purple auricles* | | |
| *Medium* | | |
| Cross No. 116 (Bhondu × Parewa) | November 2nd week | 1,987 |
| Cross No. 22 (Bhondu × Parewa) | -do- | 2,000 |
| *Late* | | |
| Cross No. 19 (Budhiabako × Parewa) | November 3rd week | 1,757 |

*Manurial requirements :* Fertilizer experiments conducted from 1935 to 1942 have conclusively proved that 20 lb. of nitrogen in the form of ammonium sulphate with 20 lb. of phosphoric acid in the form of double superphosphate per acre is the most economical dose at pre-war rates and gives significantly higher yields than either 20 lb. of nitrogen or 20 lb. of phosphoric acid applied alone, which in turn gives significant increases in yield over no manure. As fertilizers are not available during wartime, experiments were laid out on manuring paddy with oilcake in 1942-43. The results obtained at the Rice Research Station, Raipur, and other places show that 60 lb. of nitrogen

supplied through oilcakes more than double the yield, while 40 lb. and 20 lb. of nitrogen gave as high a yield as 60 per cent and 33 per cent respectively over no manure. This has enabled the cultivators to fix the most economical dose by taking into consideration the prevailing rates of paddy and oilcakes and obtain the maximum profit per acre.

### Grow more food campaign

In the beginning of 1943 when due to war the food situation in India began to cause anxiety and it was felt that the 'Grow More Food' campaign should be launched and intensified so as to increase food production to the utmost extent possible, the Agriculture Department of the Central Provinces was fully equipped with the up-to-date results on the methods of improvement of yield in paddy. Food production drive schemes and paddy seed distribution scheme were taken up in hand from 1 April 1943. Both the ways of increasing production (a) by increasing the area under paddy and (b) by improving the yield of paddy were advocated. The schemes with the results achieved during 1943-44 summarized below are:

(A) *Increasing area under paddy:* This is being achieved by:

(i) Bringing poor land under cultivation.

(ii) Diverting *rabi* area to paddy wherever it is possible.

*Bringing poor land under cultivation:* In the pre-war days when the rates of paddy were as low as 50 to 60 lb. per rupee many lands on the margin of profit were kept fallow. With the present rate of paddy of about 16 lb. per rupee cultivators have been advised to bring all such lands under cultivation. Several *malguzars* who could not manage large areas owned by them are now cultivating such lands on *adhiya*. It is expected that about a lakh of acres might thus be brought under paddy again.

*Converting rabi fields into paddy followed by utera (catch crop):* In the rice tract cultivators have been advised to divert as much *rabi* land as possible to paddy particularly wherever irrigation facilities exist. The best paying *rabi* crop at present is wheat but the calculations based on a normal yield and on current prices show that unirrigated paddy will give about Rs. 6-12 more profit and irrigated paddy about Rs. 35-12 per acre more profit than wheat. Where *utera* follows paddy there will be an additional profit of about Rs. 6 per acre. The Central Government has already sanctioned Rs. 3 lakhs for converting 20,000 acres of *rabi* area into paddy of which Rs. 1 lakh would be given as subsidy to cultivators and Rs. 2 lakhs as *taccavi* loans repayable in five years and carrying 3¼ per cent interest. The response to this item has been very favourable and it is expected that the whole allotment was to be utilized before June 1944.

(B) *Improving the yield of paddy:* This is being achieved in the following ways:

(i) Multiplication and distribution of improved varieties of rice mentioned above.

(ii) Distribution of oilcake for manuring paddy.

(iii) Distribution of sunn seed free of cost for green manuring paddy.

(iv) Construction of small village tanks and repairs of old tanks for irrigating paddy.

*Distribution of improved varieties of rice:* A scheme financed by the provincial Government and the Imperial Council of Agricultural Research has been in force from April 1942 and provides for rapid multiplication of improved rice strains and hybrids by organizing a chain of central seed farms and seed multiplication centres all over the rice tract of the province under Departmental supervision. The seed so produced is collected and distributed in a systematic manner, the sequence being as follows:

Government Experimental Farm, Raipur.

I

Six Government seed and demonstration farms.

I

160 Central seed farms of 50 acres each = 8,000 acres.

I

800 Seed multiplication centres of 50 acres each = 40,000 acres.

I

4,000 Seed farms of 50 acres each = 200,000 acres.

During 1943-44 the sequence of distribution up to 800 seed multiplication centres has been carried out and 44,675 md. of improved seed have been actually distributed. During 1944-45 all the seed from Government farms and half the produce of the seed multiplication centres would be taken over and distributed among 4,000 seed farms of 50 acres each. The total number of villages where improved seed should have been distributed by the end of June 1944 would be (160+800+4000)=4960, i.e. about one-third the number of villages in the rice tract. And the area on which improved seed will be grown would be 2·48 lakhs of acres. It is expected that the improved varieties will

then become sufficiently well-known and within the reach of every village and further expansion could be left to natural spread. Even assuming that improved strains give an increased outturn of only 10 per cent over ordinary varieties, the additional quantity of rice produced and the money earned by the cultivators would be appreciable.

*Distribution of oilcake for manuring paddy :* To supplement the stock of farmyard manure and to substitute fertilizers like ammonium sulphate and Niciphos which are not available during wartime the Central Government has sanctioned Rs. 10 lakhs for purchase and distribution of oilcake of which Rs. $2\frac{1}{2}$ lakhs would be given as subsidy to cultivators and Rs. $7\frac{1}{2}$ lakhs as *taccavi* loans repayable in two years free of interest. It will be sufficient for manuring 54,000 acres at the rate of 5 md. of cake i.e. 20 to 30 lb. of nitrogen per acre according to the quality of cake. The price of oilcake has gone very high as is the case with other commodities and this timely help from the Government in the form of subsidy has enabled the cultivators to take full benefit of the scheme and grow more food for the country and earn more profit for themselves. The demand for oilcake is great and it is expected that the whole allotment would be utilized before June 1944.

*Free distribution of sunn seed for manuring paddy :* Wherever transplantation of paddy is carried out green manuring is possible. The seed is sown in the month of May if irrigation facilities exist or with the first monsoon shower in June and allowed to grow for about a month or so. It is ploughed in at the time of preparing land for transplantation in the middle of July. It supplies about 20 to 30 lb. nitrogen per acre according to the growth made. The Central Government has sanctioned Rs. 70,000 for purchase of sunn seed and its free distribution for green manuring paddy and wheat. During 1943-44 most of the allotment was utilized. It is gratifying to note that some cultivators have already approached the Department for supplying sunn seed during 1944-45 season either free or at half or full cost as the case may be.

*New village tanks and repairs to old ones :* One irrigation at the time of *biasi* and one at the time of ripening are necessary for rice crop in this tract to ensure a normal crop against the vagaries of the monsoon. These are known as protective irrigations and save a crop which in the absence of timely rain or these irrigations would barely give 50 per cent yield. Proposals to sanction Rs. 5 lakhs for construction of small village tanks or for repairing old ones which generally can protect 25 to 100 acres of paddy grown under them are with the Government. Out of this amount Rs. 1 lakh would be given as subsidy to cultivators and Rs. 4 lakhs as *taccavi* loans repayable in five years and carrying $3\frac{1}{4}$ per cent interest per annum. Cultivators are very keen to avail themselves of this concession and it is expected that if the loan is given it would protect at least 15,000 to 20,000 acres, thereby ensuring a normal crop over much more area and also enabling the cultivators to pay off the loan from the extra profits that they would earn.

## Conclusion

The food production drive schemes and the paddy seed distribution scheme have added substantially to the agricultural wealth of the province, augmented the 'grow more food' campaign and helped to some degree to replenish the all-India deficit which formerly was met by imports from Burma. Besides, they have been of great value to research workers as well as the demonstration and propaganda staff in bridging the wide gulf between the laboratory and the cultivator's field. The financial help which is so very necessary in giving a number of occular demonstrations to cultivators has been provided by these schemes. The schemes have enabled the propaganda staff to judge more correctly the scope of expansion of various results obtained in the laboratory and the experimental farms and have also brought to light many other problems that confront the practical farmer and which require solution either in the laboratory or in the economic sphere. In fact, the schemes have proved a very valuable link through which research could be planned and propaganda work carried out.

# PRAWN AND CRAB FISHERY IN MADRAS[1]

By

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THE prawn and crab fishery of the West Coast of the Madras Presidency, is very extensive and valuable, and constitutes a major part of the general fisheries. Prawns and crabs dwell not only in the sea but in estuaries and backwaters as well. Hence, the fishery extends to these regions too. As an article of food, these crustaceans are a delicacy with the rich and the poor. Prawns and crabs are a common sight not only at the costliest banquets, but also in the miserable hovels of the poor, where no doubt it is the chief luxury.

### *Statistical studies*

Statistical studies have revealed that the prawn and crab fishery figured largely in the fisheries of the West Coast from 1931–32 to 1936–37. During this period its ranking has invariably been 1, 2, 3 and 4 among the economically important fishes that constitute the primary fisheries of the coast. For some years to come, the fishery of 1931–32 will rank as the best when a record was set up, both as regards the quantity landed (7,965 tons) and the amount it fetched (Rs. 2,65,495). On an average, about 4,082 tons are annually landed on the West Coast, and the return by way of income is Rs. 1,21,391. Following the season of plenty in 1931–32, there was a slight fall in the fishery, which extended for a period of five years (1932–33 to 1936–37) and then gradually declined to such an extent that in 1940–41 only 997 tons were landed ; which figure up to this date is the lowest ever recorded. It is proposed to investigate the causes responsible for this progressive decline in the fishery at the West-Hill Biological Station. The crab fishery, by itself does not figure prominently. On an average 23 tons are landed annually and the value realized is Rs. 886.

[1] With the kind permission of the Director of Industries and Commerce, Madras.

### *Common varieties*

The commonest West Coast prawns and crabs are *Penaeus semisulcatus* (Mal. *Valiachemmen*) ; *Penaeopsis dobsonii* (Mal. *Kozhi chemmen*) ; *Parapenae-opsis stylifera* (Mal. *Karikaddi*) ; *Metapenaeus affinis* (*Vellai Karikaddi*) ; *Neptunus sanguinolentus* (Mal. *Kannu-nandu*) and *Charybdis crucifer* (Mal. *Kall-nandu*).

### *The season*

The prawn and crab fishing commences with the breaking in of the south-west monsoon in May and extends to October. When the monsoon is on, the sea is so rough that it totally prevents sea-fishing till it has blown over. During that period the prawns and crabs occur abundantly providing the fishermen of the coast with employment and means of sustenance, and the fish-eating population with delicacy and variety. It is in this fact, and in the part which these crustaceans play in the food chain of the sea, that the importance of the fishery lies. In the sea the larvae of prawns and crabs float passively on the surface as tiny organisms. These form the food of surface feeding shoaling fishes like oil sardine and mackerel. The adult prawns are largely eaten by the predaceous fish such as shark, ribbon fish, jew fish, cat fish, cock up, thread fin, horse mackerel, sole, anchovy, big-jawed jumper, white bait and rainbow sardine.

### *Nutritive value*

The nutritive value of prawns and crabs is not so high as fish flesh, due to the lesser percentage of fat. Yet the flesh of these crustaceans contain highly nutrient substances like vitamins B and C, carbohydrates, proteins, that are required for the building up of the muscular system, iodine, phosphorus, magnesium, iron, copper, sulphur and calcium which are essential for the general up-keep of health and stamina. The deficiency in fat is made good by the presence

of some carbohydrates and starchy nutrients which are unusual in other sea fish.

The carbohydrates occur as glycogen, which is a variation of sugar and is stored up in the muscles. Whereas in other sea-food the percentage of carbohydrates is usually less than half of 1 per cent, in prawns and crabs the carbohydrate content ranges from 1 to 5·2 per cent. Further the flesh contains 23 per cent of proteins, as contrasted with 20 per cent in sea fish. The presence of such proteins gives an unusual and delicate flavour to the flesh of prawns when cooked. This adds variety and taste to the diet and whets the appetite. So there lives a scientific truth behind the conventional serving of prawns and crabs at the commencement of dinners in civilized countries. Such a procedure has been adopted not by pure accident, but by scientific reasoning, as a course with prawns really creates more appetite. Shrimps and crabs are rich in vitamins. It is estimated that lobsters contain 200 times as much iodine as milk, eggs or beef-steak, and this has been taken advantage of in the treatment of thyroid disorders. Prawn and crab meat contains roughly half as much calcium more, and five times magnesium and more phosphorus, than an equal quantity of milk. From the nutritional point of view, though the food value of prawns and crabs is not so high as fish, yet 'in no case have any food gained more recognition as having unique dietary values, than have the principal fish prawns, shrimps and crabs'.

### *Curing and preservation*

Since the prawn and crab fishery is so important a substitute for the sea-fishery during the off-season, curing and preservation become almost a necessity, particularly when the landings are heavy. The problem of curing and preserving prawns has been separately dealt with by Mr P. I. Chacko in his paper 'Prawn Curing in Madras'. The shells of prawns and crabs are powdered after blanching into fishmeal which is used as an excellent feed for poultry and cattle. Inferior quality of fishmeal is used as manure.

## SHARK LIVER OIL

THE Madras Government have approved the proposal of the Director of Industries and Commerce to prepare and market 25,000 bottles of 40 cc. each of unblended high potency Shark Liver Oil containing 12,000 I. U per gramme of vitamin A and 900 I. U per gramme of vitamin D. The price of a bottle of 'Adamin' which is the trade name given to the new preparation, is fixed provisionally at Rs. 2-15.

This development constitutes a new landmark in the successful organization of Shark Liver Oil manufacture on a commercial scale by the Madras Government. There are also private manufacturers in the field, while the Department of Modern Biology of the Travancore University have also marketed a brand and the industry does not only provide a satisfactory substitute for cod liver oil in medicine, but has significance as a welcome attempt at a scientific utilization of our fisheries.

# WATER FINDING IN THE DECCAN

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The Deccan trap country of the Indian Peninsula lies within 16°25′ to 21° N., and 72°40′ to 75°50′ E. Due to repeated draughts there is scarcity of water for drinking and for agriculture. Farming in this country is said to be a gamble in rains. Numerous wells are excavated all over the area to get water but about 40 per cent of these trials fail to yield any water, and out of the remaining 60 per cent some fail to yield sufficient summer supply. Half the amount of the national wealth spent over wells is, therefore, wasted over unsuccessful attempts, and the problem of digging wells correctly is thus keenly felt. Several methods to locate water are in practice but in this short article it is intended to give only an outline of the geological method of water finding, not commonly attended to at present in the country.

### Geological method

A most logical consideration of the occurrence of ground water is followed in this method. Underground water resides in the rocks. The porosity, retentivity, permeability and such other properties of these rocks, and the superimposition of different kinds of rocks, such as a pervious rock lying over an impervious basement or *vice versa*, would evidently influence the occurrence of ground water. A thorough study of the geological structure of the country and of the nature of the rocks reveals the ground water conditions. Exact location of water can be spotted by prospecting geologically, and the details about depth, capacity, quality etc. could also be predicted. The method is now used as the only reliable means in all civilized countries and detailed water supply surveys have been carried out in some of them on a national scale.

### Geological features

For considering the occurrence of ground water, the rocks of which the country is formed need first be studied. For our purposes the rock-formations of the Deccan trap area are first described with their reaction towards water.

*The Deccan Trap.* This is hard, compact, hypocrystalline, and is formed of lava flows which are continuous or corresponding over the area. The trap rocks form the basement, or the floor of the country. The lava flows, piled one upon another, form a thickness of about 6,000 ft. or more and they at present occupy about 200,000 sq. miles of area. The Deccan trap country is situated on this block of the lava mass which is impervious and impermeable to water. The trap rock is non-water-bearing for all practical purposes. When hard black trap rock is, therefore, met with, in wells or bores, the chances of getting water are practically nil and further trials to deepen them should be abandoned on ascertaining that there are no chances of getting an aquifer. Only in a few cases, in deep wells and bores, the trap rock abruptly ends and water bearing aquifer is met with. There are numerous instances where bores of a depth of as much as 1,100 ft. (Khambalia-Nawanagar State) in the basement trap rock have totally failed.

Fissures or cracks are produced by weathering action for a short depth below the surface of the rock mass of the Deccan traps. They are mostly present where weathering is powerful and least where it is weak. As such they are profusely developed in the vicinity of streams, in the regions where the range of temperatures between maximum and minimum is high, and they are intensely produced where such range is wide. There is a belief that springs or currents of water occur in the fissures or cracks of the trap rocks of the Deccan, and that such springs flow only along certain paths, and that wells placed by chance upon such paths of currents are successful. This is incorrect. There are evidences to show that the fissures and cracks of the Deccan trap-rocks are secondary and superficial. Under natural conditions they are usually dry or as a rule yield such permanent supply of water as is inadequate for household purposes. What are usually misunderstood for currents of water tapped in wells or bores all of a sudden, while deepening is carried through the hard black trap-rock, are really the aquifers which are abruptly met with and which yield good supply. Fissures or cracks have no directions or paths. The total volume of space for

water to reside in them is so small as will not yield plentiful permanent supply. Hence scanty permanent water is obtained from them in low lying places, while elsewhere the supply is temporary or only dry fissures are met with. These are, therefore, as a rule, not important sources of ground water in the Deccan trap country. Water from tanks, rivers, or such reservoirs may run through them into wells that are in close vicinity.

In some foreign countries, plentiful supply of water is obtained from cracks or fissures, in the rocks like basalts (akin to trap rocks of the Deccan) or quartzites etc. which are impervious and non-water-bearing like the Deccan traps. The rainfall in such countries is distributed over eight to nine months, and the reservoirs of open space in the fissures, cracks, joints etc. get constantly replenished with percolating water. In the Deccan the rainfall is spread over three to four months principally, and the ground water reservoirs once filled in are only emptied in the subsequent period of eight to nine months. The total volume of space in the fissures or cracks of the Deccan trap-rocks, is, however, insufficient to supply the water stored for twice the dry period that follows. Hence the reason why cracks and fissures do not, as a rule, form any important source of ground water in the Deccan trap country. So is the case with the quartzites of the *Kaladgis* in which the fissures and joints stand out as wide gaping cavities.

Formations contemporaneous with the trap rocks, or the lava flows are the ash beds. Ash beds occur interspersed with the lava flows. Their thickness varies from a few inches to 30 ft. or more, and they extend for many square miles. They have a texture like sponge or brick and are highly porous and water bearing. Their capacity to yield water is as high as 60 per cent by volume. They are sandwiched between two lava flows of trap rocks, and as such they are abruptly met with below the layers of hard black rocks. When tapped in this way they yield plentiful supply and the ash beds form aquifers. These are the important sources of ground water in all deep wells and bores. Ash beds below a depth of about 125 ft. usually remain dry, as they do not receive percolation water from above through the overlying impervious trap sheets. Thus ash beds do not form aquifers if they lie below the zone of weathering, i.e. the zone of crack or fissure formation, extending usually to 125 ft. below the surface. Deepening the bores beyond this depth will be futile.

The *murum*, *kankar* lime, laterite, and alluvial sands overlying the trap rocks are formations of common occurrence. They are derivatives of the black, hard rocks, and as such their texture and appearance vary to some extent according to the natural condition. They are locally formed and occur as such. The laterite covers the peaks of the Deccan mountains and the low level landscape of the south Konkan. All these formations are porous, pervious, permeable and richly water-bearing. Their capacity to yield water as ascertained in laboratory tests is 14 per cent, 35 per cent, 70 per cent and 35 per cent by volume respectively and, therefore, wells dug in these formations yield a good supply of water. Water percolates through these beds down to the floor of the impervious trap-rock upon which these formations overlie and there it stops. It then accumulates on this floor and forms a water table. Wells in these formations, therefore, yield water from such water tables. The depth of water evidently depends upon the thickness of these formations, and its capacity upon the richness of the water tables. By boring through the bottom-rock of such a well, an aquifer is also met with. The well may thus have a double source for copious water supply.

## *Prospecting*

The procedure of locating spots for water now remains to be considered and typical instances are given below.

It must be understood, however, that our aim in prospecting is to find out the possible sources out of those described above and then to conveniently locate good water-bearing spots. The black hard trap rocks are non-water-bearing and the fissures, cracks, etc. yield only scanty supply if permanent. Hence our aim must be to search out the possibility of getting an aquifer under the site selected or to get at a water table in *murum*, lime etc. whichever may occur at the site. Prospecting here, therefore, means a search for an aquifer or a water table and not a path of water current as wrongly believed. When this search is completed, depth capacity etc. could easily be ascertained as will be seen from the following cases.

At Ratlam, the author was called to locate water in the cotton mills. The site was in the lowest portion of a trough-shaped depression

formed by slopes of land, which had a mild gradient for a mile of length. The geological map showed the presence of an ash bed at a depth of about 75 ft. at the site. It was concluded that this ash bed must form an aquifer under such natural features and that depth and plentiful supply must be expected. A convenient spot was selected. A well was excavated in which an aquifer was met with, under hard black trap rock at 75 ft. depth as predicted, and the well yielded water as expected. With the mills at Sholapur the case was similar. The occurrence of an ash bed was traced to a depth of about 120 ft. below the surface. The topographical features were similar. Bores to a depth of about 125 ft. were advised and two surface bores were taken which yielded plentiful supply.

At Chas about nine miles from Nagar, in the Bombay province, the author was called by one Mr Bhong, who wanted some definite advice about water. The site was pretty flat and a small stream was bordering the field. The stream flowed for about six months in a year. Careful observations were made and it was noticed that *murum* had shown a thickness of about 30 ft. in some cuttings and exposures. It was also seen spread all over the area of about two furlongs square or more. *Murum* has moderate water bearing capacity. The nearness of a stream was considered as a most favourable factor and about one mhot of supply was predicted, at a depth of about 30 ft. from a water table in *murum*. A convenient spot was selected and a well was advised. The client excavated a well and actually got water as predicted, at 30 ft. the supply being slightly more than a mhot.

Alluvial sands and laterites also yield water similar to *murum* and instances need not be repeated.

### Conclusions

The method is simple and logical. It does not require any wonderful or elaborate prospecting. For the Deccan trap country it is the best method to follow, the aquifers and the water tables in the pervious formations being the only sources. The formations are horizontal for all practical purposes and the usual pitfalls of the geological structure, such as the dykes, faults etc. play no harmful role in the ground water hydrology of the Deccan. The method may, therefore, be followed by all workers who desire to locate water simply and successfully for the poor cultivators of the Deccan trap area.

## POSSIBILITIES FOR TROPICAL BUTTERFAT SPREAD

ONE outcome of war conditions was the production of dry butterfat from commercial butter. The process and plant for doing this was demonstrated by Dr W. J. Wiley of the Council for Scientific and Industrial Research and from this butterfat he developed a product to take the place of tinned butter in hot climates, known as Tropical Butterfat Spread, which remain firm enough to spread in temperatures slightly over 100°F. Like all new things, it is still capable of improvement, and has great possibilities after the war in countries where tinned butter finds a ready market. If a method of turning cream into dry butterfat is discovered, thus eliminating the labour and cost of making cream into butter first, then the cost of making Tropical Butterfat Spread will be greatly reduced, whilst the shipping of dry butterfat to the U.K. in place of our lower grade butters will become a distinct possibility. The New Way buttermaking process can convert this dry butterfat in the U.K. into a butter indistinguishable from fresh butter, and that would be a great accomplishment.—*The Australian Dairy Review*, August 21, 1944.

# FUZZY AMERICAN COTTON SEED AS A SAFE CATTLE FEED

By Lal Chand Dharmani, L.Ag., B.Sc.(Agri.)

*Assistant to the Agricultural Chemist to Government of Punjab, Lyallpur*

THERE exists considerable prejudice amongst the zemindars against the use of American cotton seed as cattle feed partly due to the fact that it retains a certain amount of lint or fuzz after ginning, which is wrongly believed to have a choking effect on the animals and partly due to an erroneous belief that the seed produces some heating effect and adversely affects the health of milch cattle and their milk yield. The fuzzy American cotton seed as a feeding stuff is accordingly considered to be inferior to the *desi* seed which has a very much smaller amount of lint adhering. As a result of this prejudice for which there appears to be no scientific basis the American cotton seed usually fetches a much lower price than the *desi* one—the difference generally varies from Rs. 2 to Rs. 4 per maund.

With a view to testing the validity of the prevailing prejudices and to ascertain the respective feeding values, carefully controlled feeding experiments with *desi* and American fuzzy cotton seeds were carried out only on farm animals.

## Feeding experiments

The experiments were carried out at the Agricultural College and Research Institute, Lyallpur, for long periods during all the seasons on heifers and working bullocks, and for a complete lactation on milch cows and milch buffaloes.

During these experiments the seeds of both the varieties—*desi* and American—were periodically analyzed and then actual digestibility trials were carried on to find out how much of these ingredients in the different seeds were digested. The condition of the health and the general behaviour of the animals under experiment were also carefully observed.

In regard to chemical composition, the American seed was found to be richer, both in fat and protein contents, than the *desi* seed, but the most striking fact brought to light in the course of the trials was that the protein of the American cotton seed was digested to a greater degree than was the protein of the *desi* seed.

The general conclusion arrived at from these trials was that there was no foundation for the prejudice against American cotton seed fed in amounts from 2 to 4 lb. per head per day to heifers and working bullocks; 4 to 6 lb. per head per day to milch cows and 6 to 10 lb. to milch buffaloes.

In spite of the warm weather at Lyallpur no ill effect whatsoever was noticed on the health of the animals nor were the animals ever choked as a result of the adhering lint. The milch cows and milch buffaloes fed on American cotton seed maintained their normal yield of milk and body weight.

Ghee and butter obtained from the milk of the milch cattle fed on fuzzy American cotton seed did not differ in any way from that obtained from animals fed on *desi* seed, either in chemical composition or in taste and flavour. Teats of the milch cattle, both cows and buffaloes, were never clogged on account of their being fed on American cotton seed.

As a matter of fact the American cotton seed, in spite of the adhering lint, proved superior to the *desi* varieties as a feeding stuff and is about one and a half times richer than the *desi* seed in digestible protein.

## Prejudice unwarranted

The American cotton seed constitutes a highly nutritious and wholesome ration and any fear on the part of zemindars of the fuzziness proving harmful to animals can be safely dismissed as no ill effects whatsoever were noticed on the animals during the long experimental period. It is also more economical to feed American cotton seed than *desi*, as the zemindar has to pay less per food unit for the American seed.

Similar digestibility trials on heifers, milch cows and working bullocks have also been conducted at Lyallpur with undecorticated cotton seed cake. The results obtained reveal that cotton seed cake is a cheap source of protein and can safely be fed to all classes of animals in quantities of 2 to 6 lb. per head per day.

The essential data summing up the feeding values of the various cotton seeds and cotton seed cake investigated in the manner described above, are given, per 100 lb. of the feed, in the following table :

| Name of the feed | Total digestible nutrients lb | Disgestible protein lb | Albuminoid ratio 1 : |
|---|---|---|---|
| 43–F | 89·0 | 14·00 | 6·2 |
| 285–F | 82·9 | 12·23 | 6·0 |
| 289–F | 74·2 | 11·50 | 5·6 |
| 4–F | 70·6 | 10·67 | 5·5 |
| *Desi* | 73·0 | 8·00 | 8·6 |
| Cotton seed cake | 72·5 | 18·00 | 3·1 |

# FLOWERING PLANTS WHICH ATTACK ECONOMIC CROPS

## III. LORANTHUS

By L. S. S. Kumar, M.Sc.(Lond.), A.R.C.S., D.I.C.
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*LORANTHUS*[1] is an undesirable pest found commonly on trees in fruit orchards, on trees of waste lands, and often on road-side trees. Although it is observed more frequently on fruit trees than on others, it occurs considerably on forest trees also. Trees attacked by this parasite become unsightly and these could be spotted from a distance by the characteristic growth of the parasite. It is more often found on large trees than on small shrubs or bushes. One of the sanskrit names of *Loranthus* describes most aptly the characteristics of the pest. It is called *vrikshabhaksha* (वृक्षभक्ष) meaning devourer of plant. From this it would be seen that the plant has been known in India since very early times and its ability to kill the plant which harbours it, slowly by sapping the vitality of the host, is implied in the name given to the pest.

### Feeds on its host

Since *Loranthus* contaminates the aerial parts of plants situated far above the ground level and since it entirely lacks a true root system of its own, it perforce has become dependent on the plant it attacks for its supply of water and other nutrients. These, it obtains by developing a structure called haustoria or the absorbing organ which grows into the tissues of the host. Later the haustorial tissues of the parasite become intimately associated with the tissues of the host, which conduct nutritive material. From the connection thus established with the host, *Loranthus* absorbs its requirement of nutritive material.

The continuous drain of nourishment by the parasite deprives the host plant of what is required for its own growth. Thus in course of time the attacked branch withers because of the interference in the flow of the sap to its leaves beyond the point of attack. *Loranthus* has green leaves of its own wherein the building up of carbohydrate food material essential for its development takes place. But carbohydrate is only one of several kinds of food materials required for plant growth. Since it partly provides for its own nutrition and depends on its host for only the remaining part, it is included in the class of plants called hemi or partial parasite.

### Description of the parasite

*Loranthus* has drooping branches which appear to arise in a cluster at the point of attack. This cluster forms a dense, bushy growth which is marked by contrast to the well-dispersed arrangement of branches and leaves of the host. The leaves are thick and fleshy. The place, at which the host is attacked and where the haustoria penetrates, swells and in course of time forms a large tumor. The size of the tumor varies according to the age of the parasite (fig. 2, plate No. 45). Each year the tumor increases in size and on large host trees the tumor often attains a foot or more in diameter. Sometimes the parasite instead of confining its attack to one place produces a creeping branch which grows closely adpressed along the host stem. On this creeping branch haustoria are formed at intervals. The flowers are borne in clusters and they are long and tubular in shape, usually greenish white in colour or red according to the species. The fruit is a berry scarlet-red in colour. Within the fleshy fruit the solitary seed is embedded in a sticky mucilagenous pulp. The fruit is sweet and is eaten by birds and other animals.

### Dissemination of the parasite

The parasite spreads by the dispersal of its seed mostly by birds and to some extent by other animals. The birds are attracted by the brilliant colour of the fruit and its sweet pulp. By providing it with a sticky pulp and attractive fruit nature appears to help in its propagation. When the pulp is eaten the seeds stick

[1] The common names by which *Loranthus* is known are given below :—

| | |
|---|---|
| Latin | — *Loranthus longiflorus.* |
| English | — Loranthus. |
| Marathi | — *Bandgul, bindukli, kainguli, vanda,* and *madhukari.* |
| Gujarati | — *Vando.* |
| Kannada | — *Badanike, benduka, muduka.* |
| Hindi | — *Banda.* |
| Hindustani | — *Pand.* |
| Sanskrit | — *Vrikshabhaksha, Vrikshadani* and *Vriksharuha.* |

to the beaks of birds or pass through their body without being injured. The seeds adhering to the beaks of birds are got rid of by rubbing them against the bark of branches on which the birds find a perch. Thus the seed gets deposited on another branch of the same or of a far-away tree. Likewise the droppings of birds containing seeds of *Loranthus* may fall on the branch of the same or some other tree where the seeds germinate as soon as conditions become favourable.

The seed on germination first gives rise to the haustoria by which the parasite quickly tries to establish its connection with the host plant by the penetration of the haustoria into the branch. Later with the appearance of the first pair of green leaves the semi-independent life of the parasite begins.

### Damage to the host

In the early stages, the effect of attack may not be appreciable. But as the parasite increases in vigour and in extent the effect begins gradually to tell on the host. Beyond the point of the parasite's attack, fresh growth of host shoot becomes stunted, and this is particularly marked in the case of the mango which is the commonest of the fruit trees to be attacked by the pest. The effect of attack also depends on the vigour of the host itself. A very large tree if sparsely attacked will hardly show any effect. Large trees when profusely attacked begin to get affected and these trees die a lingering death (see fig. 1 plate No. 45). The effect of attack is most marked on the production of new growth which in turn affects the quality and yield in the case of fruit trees and the value of timber in the case of forest trees. One of the characteristics of attack is that the leaves of severely affected trees become reduced in size and acquire an unhealthy green colour. No exact estimate of loss in money value has yet been made regarding the damage caused by *Loranthus*. But looking to the thousands of trees affected all over the country the damage must amount to a very considerable sum.

### The parasite and its hosts

There are in all about 350 species of *Loranthus* mostly of tropical habitat. Of these about 55 species are reported to be growing in India, Burma and Ceylon. The host range of the parasite is equally wide. In Table I is included a list of some of the well known fruit trees attacked by *Loranthus*.

TABLE I.

| Botanical name | English name | Marathi name |
|---|---|---|
| *Mangifera indica* Wall. | Mango | *Amba* |
| *Artocarpus integrifolia* L. | Jack fruit | *Phanas* |
| *Anona squamosa* L. | Custard apple | *Seetaphal* |
| *Citrus aurantifolia* S. | Lime | *Limbu* |
| *Citrus nobilis* S. | Orange | *Santra* |
| *Phyllanthus emblica* L. | Phyllanthus | *Awala* |
| *Eugenia jambolana* Lam. | Eugenia | *Jambhal* |
| *Psidium guyava* L. | Guava | *Peru* |
| *Punica granatum* L | Pomegranate | *Dalimb* |
| *Tamarindus indica* L. | Tamarind | *Chinch* |
| *Zizyphus jujuba* Lamk. | Jujube | *Bor* |
| *Ficus carica* L. | Fig | *Anjir* |

Besides the fruit trees listed in Table I above, in Table II are included names of host trees found commonly grown for shade along road sides and those found growing in waste lands. These two lists are by no means exhaustive but are sufficient to show the omnivorous character of the pest.

TABLE II.

| Botanical name | Marathi name |
|---|---|
| *Acacia catechu* Willd. | *Khair* |
| *Albizzia lebbek* Benth. | *Shiris* |
| „ *procera* „ | *Kinai* |
| *Artabotrys odoratissimus* Br. | *Hirva chaffa* |
| *Bombax malabaricum* D.C. | *Sayari* |
| *Butea frondosa* Koniag. | *Palas* |
| *Dalbergia sissoo* Roxb. | *Sisvi* |
| *Bauhinia racemosa* Lam. | *Apta* |
| *Euphorbia tirucalli* L. | *Sher* |
| *Ficus bengalensis* L. | *Wad* |
| „ *glomerata* Roxb. | *Umber* |
| „ *religiosa* L. | *Pimpal* |
| *Melia azadirachta* L. | *Neem* |
| *Millingtonia hortensis* L.F. | *Kanadya neem* |
| *Moringa pterygosperma* | *Shevga* |
| *Morus alba* L. | *Tuti* |

### Eradication of the pest

It is, however, astounding to think why the people have come to tolerate this pest. Its unsightliness alone should have been a sufficient cause for any one to get rid of it. But on the contrary it has been allowed to multiply unconcerned and is even found on some of the trees in well-kept gardens, Government farms and on road side trees of big cities. As for the countryside, it is a woeful sight to see thousands of trees attacked and nothing being done to prevent the spread. It should now be realized that this neglect has reached its limit and the time has come to start a clean-up campaign which could only be done through co-operative efforts of willing workers organized in a systematic manner.

In removing the parasite, wherever possible, attempts should be made to save the

host. In extremely early stages of attack the parasite could be detached without causing any damage to the host. If the tumor caused by the parasite is on one side of the branch, all that would be necessary is to saw off close to the branch below the tumor. When the branch itself gets included in the tumor the entire branch below the tumor should be sawn off to save other healthy branches from further attack. The cut surface of the host tree should be protected by an application of creosote or some other protective chemical. If this is not done the cut surface will offer entry to fungi and bacteria, and thus the remedy may be worse than the disease. In severely affected cases it would be best to uproot the entire tree which sooner or later is likely to be killed otherwise.

Wherever the parasite is found, whether on economic or wild trees growing in waste lands, orchards or along road sides, it should be promptly removed before it has had time to grow, produce flower and set fruit. Unless this is systematically done neglect will result in damage to hundreds of useful trees. In badly infested areas the inhabitants of several villages should organize themselves into groups and take up concerted measures for the removal of the pest within the area. The clean-up should be thoroughly undertaken so as to ensure that all traces of the parasite are totally removed. Rural reconstruction workers and village school teachers should be made propagandists for the clean-up campaign of *Loranthus*.

Village urchins, cowherds, and shepherds, who often lop off branches of trees to feed the cattle should be instructed to remove the parasite wherever and whenever seen. The harm caused by the parasite must be clearly impressed on the minds of every villager so that no one will allow the parasite to grow. Just as tree planting days, or village cleaning days are being organized as measures of rural reconstruction, a day for the clean-up of *Loranthus* may also be organized. Only a systematically arranged campaign against *Loranthus* could check its spread and aid in its final eradication.

## ASPERGILLUS NIGER

THE U. S. Department of Agriculture is using the mould *Aspergillus niger* as the basis for a quick, precise and economical method for determining whether or not various of the rarer elements in soils are essential to plant growth. The mould has the same mineral requirements as green plants except that it has no need for calcium, silicon, or boron. Almost microscopic, the mould is handy to use as a test organism where conditions of extreme purity are required because of the great importance of extremely small quantities of so-called micronutrients. Quoting Dr Robert A. Steinberg of the Department: 'We know as a result of our experiments that the few parts per million or per billion of the elements zinc, copper, molybdenum and others, are as important to the growth of test mold as the much larger quantity of the better known plant food elements—potassium and phosphorus. It tells us in particular cases what we want to know about the presence or absence of any of these micronutrients, which are just as important to field, garden and green-house crops as they are to this mold.'—*Australian J. Sci.* 7 (2), 54; Oct. 1944.

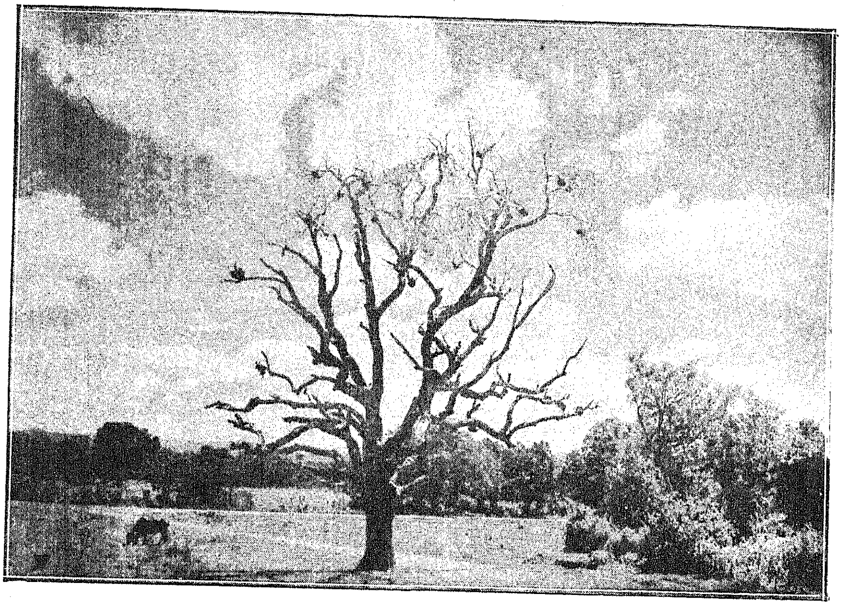

FIG. 1. Severe infestation causing death of a mango tree

[ *By Courtesy of the Fergusson College Magazine* ]

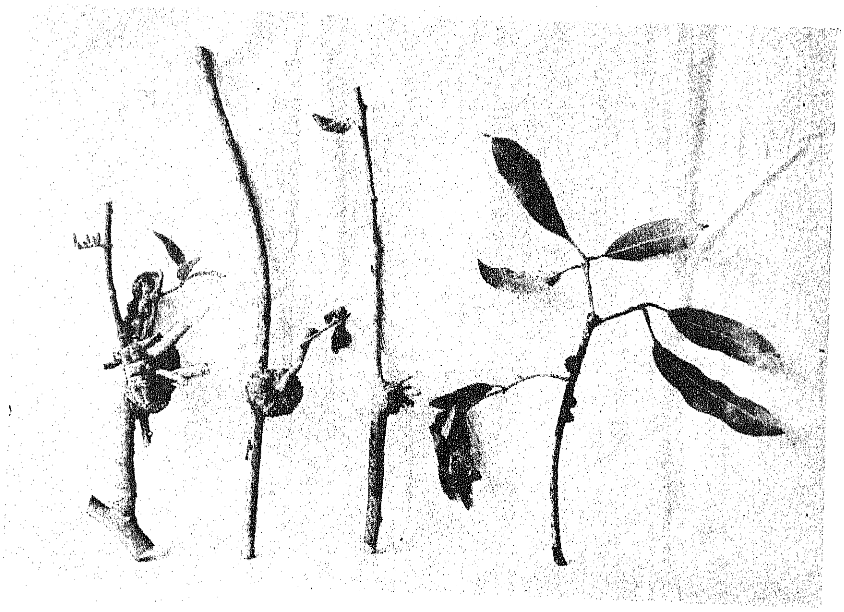

FIG. 2. Stages (right to left) in tumor development

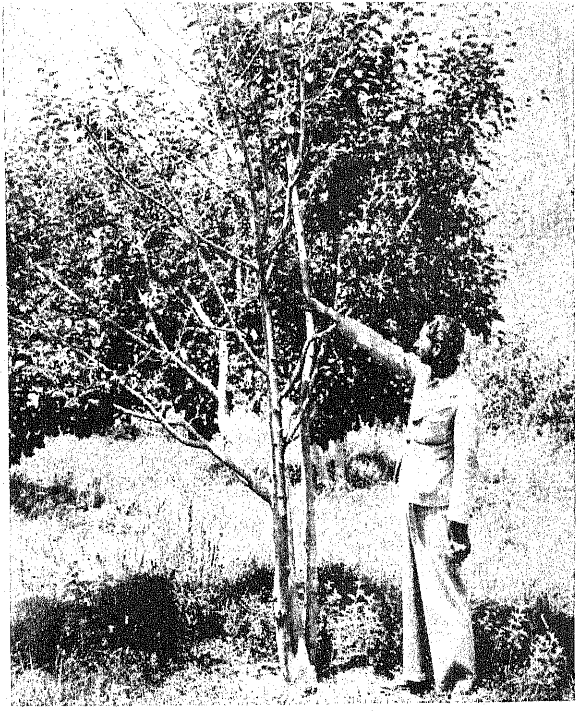

FIG. 1. Apple tree showing damage by San Jose Scale

FIG. 2. Mango mealy bug

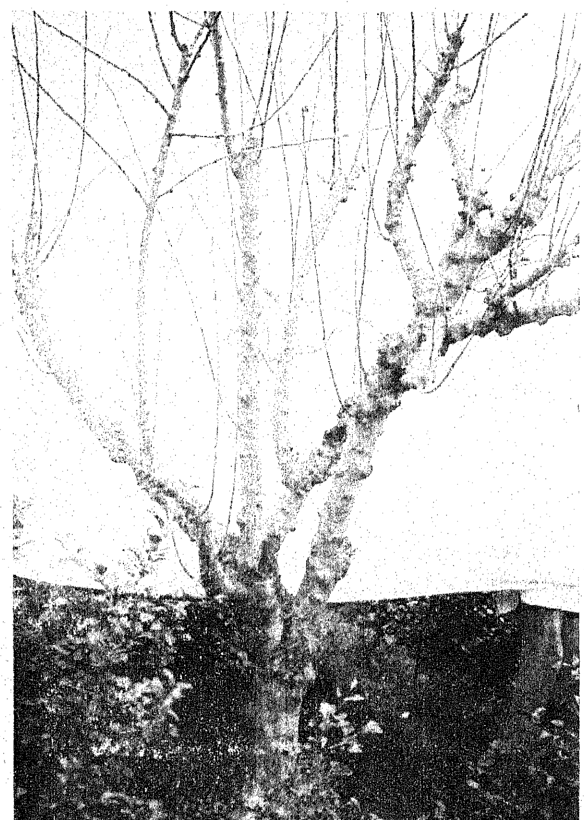

FIG. 3. Apple tree showing damage by woolly aphis

FIG. 4. Almond tree showing damage by *Mimastra Cyanura*

# INSECT PESTS OF FRUIT TREES[1]

By Khan A. Rahman

*Entomologist to Government, Punjab, Lyallpur*

A combined Entomological Scheme in the Punjab and the North-West Frontier Province was started in April 1937 for three years under the auspices of the Imperial Council of Agricultural Research with head-quarters at Lyallpur. The main objects of the scheme were : (1) survey of the insect pests of fruit trees only, with special reference to the present distribution of San José Scale and its host plants, (2) survey of the wild host plants of San José Scale, (3) study of the importance of the infested fruits in the spread of San José Scale, (4) examination and fumigation of live plants entering India at Peshawar and (5) examination of fruits entering India through Peshawar and the Kurrum Valley. The data collected during the life of the scheme are briefly discussed in this article.

### *Insect pests*

*San José Scale* (*Aspidiotus perniciosus*, Comst: Rhynchota) : In the Punjab and the United Provinces, San José Scale is found in the hilly tracts while in the N.W.F. Province, in addition to the hilly tracts, it is also found in Peshawar. It feeds on the following plants : Alder *Kosh*; almond ; wild almond; *akik* ; apple; crab apple ; *alubukhara* ; apricot ; wild apricot ; *bhang* ; cherry ; chestnut ; hawthorn ; *mahan* ; oak ; peach ; wild peach ; pear ; wild pear ; plum ; *cherai* (Parachinar local plum) ; Japan-plum ; wild plum ; quince ; rose ; Persian rose ; walnut ; and willow. The attacked plant is ultimately killed.

San José Scale is reported here for the first time on *akik* and *bhang*. The pest hibernates as a young nymph underneath a black scale. The over-wintered nymphs resume feeding in February-March. A month later, the male scales can be distinguished from the female scales. Males emerge in April-May and after fertilizing the females, they perish. Crawler nymphs appear in May. They crawl at the rate of 14·4 in. per hour and after 24 to 48 hours' active life, they fix themselves on the food plant on which they have been born, each nymph ultimately covering itself up with a white waxy scale. The nymphs reach maturity in about 40 days. This active reproduction is continued up to 15 December when hibernation starts.

San José Scale is commonly distributed on nursery stock, scion and graft. Birds[2], bats[3], insects, labourers and cattle grazing in an infested orchard, also help to spread it. It has been established by experiment that nymphs produced on infested fruits (an infested fruit was found to have as many as 1,988 nymphs on it) can crawl to a distance of 20 ft. along the ground to infest a plant.

San José Scale is parasitized by an unidentified chalcid which is active during August and September in the Kurrum and Kulu Valleys : *Chilocorus* spp., *Coccinella septempunctata* L., and *Cypocephalus* sp., and *Chrysopa* sp. prey upon it during July-October in Alizai and Parachinar. A mite has also been found predaceous upon its crawler nymphs in the Kurrum and the Kulu valleys.

*Mango Mealy Bug* (*Monophlebus stebbingi var. Octocaudatus* Green : Rhynchota) : This pest has been collected from Jharoli (Suket State), Kohala, Lahore, Lyallpur, Murree, Muzaffargarh and Sialkot in the Punjab and Abbotabad, Bannu, Dera Ismail Khan, Haripur, Kohat, Parachinar, Sheikhulbondi in the N.W.F. Province infesting the following fruit trees : apple, *ber*, citrus, grape, vine, fig, guava, *jaman*, loquat, mango, mulberry, plum, walnut, cherry, peach and pear.

The eggs hatch from the beginning of January to the end of March, depending upon the locality. The tiny nymphs climb on trees and fix themselves upon the terminal portions of their tender shoots. The males appear on the wing in April when they fertilize the females. These females descend from trees generally during May-June and enter the soil wherein they lay eggs in whitish silken sacs.

The pest sucks juices from the terminal fruiting branches and the attacked plants produce no fruit at all.

[1] A comprehensive bulletin on the insect pests of fruits in N. W. India by the writer is under publication with the Imperial Council of Agricultural Research.

[2] Yellow-billed magpie, the Indian jungle crow, house crow, myna, Simla streaked laughing-thrush, and white-cheeked bulbul.

[3] Flying fox.

*California Red Scale.* (*Aonidiella aurantii* Mask : Rhynchota) : Of the various scales found on fruit trees in north-western India, California Red Scale deserves special mention. This is a very widely distributed pest of citrus in the Punjab and the N.W.F. Province. Its potentialities for damage are little recognized at present. In addition to citrus, it is also found attacking *jaman* and *guava*. The attacked leaves turn yellow and fruit becomes spotted and unmarketable. This pest is usually distributed on nursery stock.

*Mango-hoppers* (*Idiocerus* spp : Rhynchota) : These major and specific pests of mango have been collected practically from every locality where mango is grown. The nymphs suck the juices from the panicles which wither and dry up and their flowers fall off prematurely. An effective and easy means of control of these pests yet remains to be discovered.

*Citrus Psylla* (*Diaphorina citri* Kuw : Rhynchota), and *Citrus White Fly* (*Dialeurodes citri* Ashmead : Rhynchota) : They are widely distributed in north-western India and in all localities of their occurrence they inflict serious losses on citrus growers.

*Woolly Aphis* (*Eriosoma lanigerum* Hausm : Rhynchota) : This pest is present in the Simla Hills and the Kulu and Kurrum valleys. Its parasite (*Aphelinus mali* Hald) introduced into the Punjab in 1936 is now well-established in the Kulu Valley where it keeps the pest under complete check[1].

*Peach Curl Aphis* (*Brachycaudus pruni* Koch : Rhynchota) : Of the other aphis found damaging fruit trees in north-western India Peach Curl Aphis deserves special mention, as this aphis is one of the most destructive insect pests brought to light by the survey staff. It is most probably present in all the localities where its food plants are found but it has been actually recorded from 33 localities in the Punjab and 16 localities in the N.W.F. Province. It attacks peach, plum, apricot and almond but it is most severe on peach.

The females start reproduction towards the end of February. Each female can produce more than 50 nymphs in about 13 days. The nymphs reach maturity in 9 to 10 days. The insect passes through seven generations on the peach plant from the beginning of March to the end of April.

The attack begins on peach in the end of February and is continued till the end of April. The attacked leaves get folded and cupped in an ugly manner. From one quarter to the whole of the fruit from an attacked tree is shed. Whatever fruit is left on the tree is of very poor quality; most of it is shrivelled up. Orchardists maintain that an attacked plant does not bear fruit of normal quality in the following year also.

This insect is preyed upon by a number of lady bird beetles and Hover flies but none of them exercises any check on it. It is imperative that an investigation on this pest should be taken up immediately with a view to discover effective means of control.

*Apriona cinerea* Chev. (Lamiadae : Coleoptera): This insect is recorded for the first time as a very destructive pest of apple ; in some orchards every plant may have 40 per cent of its branches attacked.

The adults are active from May to August. The females lay eggs on branches in cavities made with their mandibles. The grubs on hatching tunnel into the branches and work their way through the limb to the portion of the stem near or slightly above ground level. The grub bores six to nine holes to the outside at two to five feet intervals all along its tunnel. There may be seven or more grubs in a stem. Heaps of chewed up plant fibre mixed with excreta underneath the plant betray the presence of larvae inside the stem. The grubs hibernate in the tunnel during December-February. They resume feeding in March. The tree attacked by this pest is usually killed.

*Mimastra cyanura* Hope. (Chryso-melidae : Coleoptera) : This is another destructive pest which has been brought to light by the survey staff.

It has a restricted distribution in the Punjab and the N.W.F. Province. It feeds on peach, pear, almond, mulberry, plum, apricot, and pomegranate. Its attack is particularly severe during April-June. After reducing the leaves of the attacked tree to skeletons it migrates in dense swarms to healthy plants. In case of severe infestation even the bark is attacked.

*Buprestid Borer* (*Sphenoptera lafertai* Thoms.) Buprestidae : Coleoptera) : This insect though widely distributed in the N.W.F. Province does the greatest damage in the Bannu district. It is a serious pest of plum and peach but it also attacks apple, apricot, loquat, pear and cherry.

The full-grown grubs pupate in April and the adults appear on the wing during April and May, when the females lay whitish eggs in cracks

[1] For detailed information on *woolly aphis* and its parasites see Rahman and Khan : *Ind. J. agric. Sci.* Volume XI, Parts II and III, pp 265 & 446, 1941.

and fissures of the stem. The grubs on hatching burrow below the bark where they feed, saw dust in crevices of the bark betraying their presence. Grubs are commonly found from June to August. As many as three may be found in a 3 in. × 1 in. branch. The attacked plant is usually killed.

*Codling Moth* (*Carpocapsa pomonella* L : Lepidoptera) : Of the butterfly and moth pests of fruit trees in north-western India, the codling moth is the most destructive. It is at present confined to the Kurrum valley where it destroys apple, crab-apple, pear, peach and quince.

Codling moth hibernates as a larva under cover of the bark from November to March. Two to twelve caterpillars may hibernate together and there may be 8 to 22 on a single stem up to a height of 12 ft. from the ground.

This is the most destructive of all apple pests. It may destroy 90 per cent of the fruit during June-August. Because of the ravages of this pest farmers are abandoning the cultivation of apple in the Kurrum valley. The young caterpillar may enter the fruit at any point although most enter through the calyx cup or its vicinity. Infested fruits are the common means of dispersing this pest[1].

*Fruit Flies :* The Fruit Flies are known to occur in the N.W.F. Province since 1921 but it is only during the last six years or so that they have assumed destructive proportions. At present these insects constitute what appears to be an insurmountable obstacle in the development of fruit culture both in the Punjab and N.W.F. Province. Hence initiation of research on the control of these pests is the urgent need of the day. Eleven species of the fruit flies were collected from the N.W.F. Province and the Punjab. Of them *Dacus ferrugineus* F. is commonest in the former and *D.zonatus Sarund* and *D.cucurbitae* Coq. *Myiopardalis* sp. and *Carpomyia vesuviana* Costa. in the latter province.

Fruit Flies have been collected from the following fruits during the months noted against each :

| | |
|---|---|
| *Guava*, cucurbits | January–April |
| *Loquat* | April–May |
| Bannu local apple, apricot, plum, mango, peach, pear, wild fig | May–June |
| Peach | July–August |
| Pear (cultivated and wild), mangoes | July–September |
| Pomegranate | August |
| Fig, guava and citrus | August–December |

[1] For control of codling moth see 'The codling Moth and its control' by S.C. Roy : *Indian Farming*, Vol : II, 399-403, 1941.

The attacked fruit is maggoty (each fruit may have from 2 to 38 maggots) and is unfit for human consumption. Upto 92 per cent of the fruits may be damaged and once the Fruit Flies have entered an orchard its income may fall by 71 to 90 per cent.

*Apricot Chalcid* (*Eurytoma samsonovi* Vass. Chalcididae : Hymenoptera) : Apricot chalcid is widely distributed in the N.W.F. Province but it does the greatest damage in Haripur *tehsil*. It has so far not been recorded as occurring in the Punjab but its presence is suspected in Choa Saidan Shah (District Jhelum). It is the most destructive pest of apricot but it also attacks peach, plum and almond. A female lays 1 to 3 eggs in a fruit below its skin. The grubs take nine months to three years to reach maturity but the pupal stage is completed in 12 to 23 days.

Its attack commences in April–May when the grub enters the kernel of apricot fruit and eats up its contents. The affected fruits shrink and fall down. The loss caused by this insect in Haripur *tehsil* alone is said to run into thousands of rupees annually. The pest is, therefore, a serious one and demands immediate attention.

### *Need for examination of live plants and fruits*

San José Scale usually enters a country or a locality through nursery stock, which may be obtained locally, from outside the province, or from foreign countries. Legislation which has been recently enacted by the Government of India will go a long way in stopping the further spread of San José Scale in India. The salient feature of this Act is that the export of specified food plants, likely to carry San José Scale from the Punjab, British Baluchistan, N.W.F. Province and certain scheduled states is permitted only (1) by road along prescribed routes and (2) by rail and inland steam vessel when accompanied by a certificate of freedom from living San José Scale.

### *Quarantine and control*

Fruit that enters the Punjab and N.W.F. Province is classified as fresh fruit and dry fruit. Fresh fruit is produced locally and is also imported from outside, particularly Kashmir. By actual examination of the incoming fruit at the frontiers it has been established beyond doubt that, some of the fruit coming from Kashmir is infested with San José Scale and on examining Kashmir fruit in the Punjab

markets, it was found that the pest reaches its destination alive and is capable of starting new infection. Similarly codling moth was intercepted on apple fruits imported from Kabul into Bannu and the Kurrum valley, in September. Crab apple produced in Kurrum valley finds its way into the markets of Kohat and Peshawar in N.W.F. Province and Sargodha, Lyallpur, Multan and Montgomery in the Punjab. In September, 1938, living codling moth caterpillars were found in the Kurrum valley crab apple in Kohat market. It is thus seen that codling moth is regularly imported from Afghanistan into India and that Kurrum valley apple may spread this pest to other parts of India. In view of these findings (a) strict quarantine measures should be immediately enacted to safeguard against the spread of this terrible scourge of apple to other apple-growing tracts in India, and (b) control measures should be undertaken at once in the Kurrum valley to eradicate it.

Dried fruits are imported into India chiefly from Afghanistan during September-February mainly through the Khyber Pass. The entomological examination of this fruit was carried out at Peshawar and Bannu and a number of both known and new insect pests were intercepted. This work, which by no means is exhaustive, establishes the fact that insect pests of dried fruits are entering India, regularly and continuously, and it is imperative that detailed observations on them should be initiated without further loss of time with a view to discovering their identity, life histories and means of controlling them.

## INSECTS IN GRAIN CAN BE CONTROLLED

THE insect damage in Canda to many of the products so essential to man represents an enormous sum annually, said H. E. Gray, Division of Entomology, Science Service, Dominion Department of Agriculture, at the recent annual meeting of the Pest Control Operators' Association, held at Montreal. It is estimated in the United States that the damage by insects to stored grain and cereal products alone exceeds a total of at least 300 million dollars, or a sum in excess of two dollars for every citizen of the country. While the climate in Canda, said Mr. Gray, is distinctly less favourable than that of the United States for the development of insect pests, Canadian losses are nevertheless large, and a considerable portion of them might be avoided by carrying out suitable control measures at the right time.

The losses suffered by stored products insects fall into a number of categories : (1) actual feeding by insects ; (2) contamination by presence of insect stages of life, excrement and webbing ; (3) changes in the appearance of the product ; (4) damage to containers ; (5) damage to buildings ; (6) increased cost of the product because of the necessity of trimming and reprocessing ; (7) incidental damage ; (8) aesthetic damage, that is, such as the loss of custom.

Food manufacturers and others can do a great deal to prevent damage to stored commodities by arranging that inspections are made regularly and carefully. Either a qualified employee should be chosen or the services of a pest control operator should be secured on a contract basis for this service. Frequent inspection will keep the manufacturers advised as to the condition of the stocks on hand and infestations can be stopped before they have become well started.

# IMMUNITY AGAINST DISEASE

By N. B. Das, Ph.D.

*Assistant Research Officer, Imperial Veterinary Research Institute, Mukteswar*

MANY diseases are caused by certain minute organisms, which are able to gain access to the tissues and produce disease only when the natural defences of the animal body—both mechanical and chemical—are weak or run down. Here only the chemical defences of the body will be dealt with. The minute organisms are roughly classified into 'saprophytes' and 'parasites' according to the conditions required for their multiplication. The former can live and multiply outside the animal body when provided with simple food materials, like inorganic salts, while the latter require for their sustenance much more complex substances like protein, carbohydrate and vitamin. The parasites are chiefly responsible for various infectious diseases and generally thrive well on animal tissues which supply them with all necessary nutrients. Conditions, which favour the growth and maintenance of these parasites, such as proper temperature, humidity, food material, etc. also favour the spread of diseases caused by these parasites.

## *Immunity*

An animal is said to possess immunity against a disease when it is not susceptible to that disease, or in other words to the parasite which causes that disease. Immunity may be either natural or acquired. Natural or inherited immunity has often been found to vary with species, race, individual peculiarities and surrounding conditions and is certainly not proof against all adverse circumstances. Acquired immunity, on the other hand, is developed either by passing through an actual attack of disease or by artificial inoculation. Men and animals once attacked by such diseases as plague, cholera, smallpox, yellow fever, etc. do not usually contract the same disease again. They are, therefore, said to have acquired permanent immunity, while diseases like pneumonia, influenza, gonorrhea, etc. produce little or no immunity. The methods of producing immunity by artificial inoculation will be dealt with later.

## *Toxin - antitoxin*

The balance of health and disease is maintained by a constant struggle between the invading parasites and the animal. The parasites elaborate certain poisonous chemicals which cause diseases while the animal body struggles hard for protection against their poisonous attack by producing certain anti-poisonous substances. These poisonous chemicals, called 'toxins', are either 'intracellular' or 'extracellular', that is, they are either bound up with the body of the parasite, or are excreted into the surrounded medium by the parasites. Intracellular toxins get into the blood stream only when the parasites die and their body cells are disintegrated. Extracellular toxins, on the other hand, are constantly excreted by the living parasites into the blood stream. Nothing is known definitely about the chemical nature of toxins but they appear to be colloidal[1] in nature. Neither do we know how the toxins disturb the general activities of the life process. Extracellular toxins, when inoculated into the animal body, give rise to new specific substances in the blood stream called 'antitoxins'. Antitoxins mixed with the poisonous toxins yield non-toxic products. Intracellular toxins are not capable of producing antitoxins.

## *Antigen-antibody*

Immunity is induced by certain substances called 'antigens' elaborated in the body of the parasites. These substances when inoculated into the animal body give rise to new specific substances called 'antibodies' in the blood stream. Many soluble foreign colloidal substances work as antigens in exciting the formation of corresponding antibodies. In recent years the greatest advancement in the chemistry of immunity is the discovery of the chemical nature of certain antigens. For long, antigens were all believed to be proteins. It is only in the last decade that some polysaccarides[2] have also been found to possess immunological reactivity. Some of the polysaccharides, isolated from the body of the parasites, are incapable of exciting

[1] A 'colloid' is a substance which does not diffuse through the invisible pores of most membranes, e.g. a collodion membrane, and is not sedimented by centrifugal force.

[2] Polysaccharide—A carbohydrate consisting of many molecules of simple sugars.

antibody formation when inoculated alone, but when inoculated together with an immunologically inactive protein, spontaneously give rise to antibody formation. Such antigens, therefore, consist of two components : a polysaccharide and a protein. Lipoids[1] also occur as a component of certain antigenic complexes. There may be other unidentified components of antigens as well. Organisms are now-a-days distinguished by their antigenic nature.

It has already been mentioned that antigens when inoculated into the body give rise in the blood serum to specific antibodies or immune bodies, which are responsible for the chemical defence of our body against parasitic attacks. Our knowledge of the chemistry of antibodies is, at present, very poor. They appear to be proteins and are found associated with serum globulin, euglobulin or pseudoglobulin, which are normal protein constituents of blood serum. Each antigen gives rise to a specific antibody. The mechanism by which antibodies are formed is not known but it has been found that a minute quantity of antigen can give rise to an unlimited quantity of antibody and no constituent part of antigen has been found to be incorporated into antibodies. Antibodies are frequently found in the normal blood serum even before immunization. They are, therefore, normal constituents of the blood, whose deficiency makes men and animals susceptible to diseases. It may sometimes be possible to distinguish health and disease by analyzing the antibody content of the blood serum of animals. A soluble antigen, when added in definite proportion to the antibody-containing serum or to the purified antibody, forms a visible precipitate. This is, no doubt, a chemical reaction as it follows certain laws of chemical combination. The bulk of the precipitate contains proteins of the immune serum and there is relatively a little of the antigen in the precipitate.

### *Artificial immunity*

It was also stated earlier that immune bodies can be produced artificially in the animal body. This is done either to induce immunity in animals which lack it or to reinforce animals possessing natural immunity. It is proposed to give here a short description of the methods, as their knowledge is of considerable importance in the maintenance of our health. Artificial immunity is produced by the following methods :

1. By a series of injections of living but attenuated (weakened virulence) parasites. The process of attenuation or weakening of virulent organisms is very interesting and deserves mention. Most of the deadly organisms partly lose their virulence, (a) when grown outside the animal body in artificial media under unphysiological conditions, such as high temperature, abnormal gas pressure, or in the presence of weak antiseptics like lysol, formalin, etc. ; (b) by passing the organisms repeatedly through the tissues of one species of animal, whereby the virulence for another species of animal is diminished.
2. By a series of injections of non-lethal doses of fully virulent organisms. The deadly organisms are to be injected in such small amounts that the body can easily overcome the harmful effects. Sometimes the organisms are treated with the corresponding antibody containing serum before inoculation. This produces immunity for longer periods and has been applied in vaccination against typhoid, cholera, dysentery and plague.
3. By injections of organisms killed by either antiseptics or heat. In some cases a high degree of resistance is formed by this method.
4. By injections of toxins. When the organisms are grown artificially in liquid media, the toxins are excreted into the fluid. This fluid is ultimately freed from the organisms by filtration and is inoculated in (gradually increasing) small doses. Immunization against diphtheria and tetanus is done by this method.
5. By transferring antibodies from one animal to another. This is done by injecting the antibody-rich serum of an immunized animal to another susceptible animal.
6. By the combination of any two or more methods described above.

### *Conclusions*

From the foregoing facts it is quite apparent that our body by mobilizing immune bodies is normally equipped to fight invading parasites when these are not present in overwhelming forces. But a regular supply of various raw materials is needed by the system to manufacture the weapons for fighting these enemies. Some of the essential raw materials are the different constituents of our food, such as, protein, carbohydrate, fat, mineral salts and

[1] Lipoid—A substance insoluble in water but soluble in chloroform, alcohol, benzene and ether. Occurs in all living cells.

vitamins. It is not possible yet to tell with certainty the quantitative requirements of these food constituents for people of different age, constitution and profession, especially for protection against illness. But indications are many to point out that their requirements are different for different classes of individuals. Deficiency or inadequacy of any of these constituents of food perhaps increases the susceptibility of an individual by lowering the vitality. Effort is being made by scientists to ascertain the various factors involved in combating a disease and to lead us towards a more perfect health and happiness.

## ANIMAL DISEASES WHICH AFFECT MAN

FROM as far back as the days of the ancient cave man, who contracted deadly anthrax from wearing the skins of wild animals, medical and veterinary science reveal numerous diseases which both animals and men share in common. The germs of Bang's disease may cause undulant or Malta fever in man; erysipeloid (not to be confused with human erysipelas) may be transmitted to man through swine erysipelas; 'food poisoning' diseases result from eating uninspected or diseased meat or from milk from cows suffering from mastitis; trichinosis is sometimes contracted by man through eating raw or partially cooked pork which contains the trichina parasite, occasionally found in swine; sleeping sickness in horses may infect man with a similar type of disease, and the highly contagious and deadly anthrax may be passed on to man through contact with the carcasses of animals which have died of that disease or from contact with the germs wherever they may be.

In combating these diseases, veterinary science has made great strides but perphaps one of the greatest victories of the veterinarian in protecting mankind from disease is the achievement in Canada during the past 25 years in curbing bovine tuberculosis. Before this nation-wide campaign was instituted, the non-pulmonary type of human tuberculosis, transmitted to human beings through the milk of tuberculous cows, was the cause of a heavy death toll. Today this type of tuberculosis is rarely seen in hospitals. But the fight is not over. There may still be residual bovine infection in some areas. Cattle must still be tested to prevent a recurrence of this disease, and to maintain what has proved to be a great contributing factor to the health of the nation. The control of bovine tuberculosis is a great triumph—but never ending fight—to Canadian veterinarians and veterinary authorities as represented by the Health of Animals Division, Dominion Department of Agriculture, because in years gone by they had to fight apathy which was general.

# CATTLE WASTES IN INDIA

By C. N. Acharya, D.Sc. (Lond.), M.Sc., Ph.D., F.I.C.
*Chief Biochemist, Imperial Council of Agricultural Research*

THERE exists a considerable amount of uncertainty around the question of the quantity of cattle wastes produced in India and the quantity of farmyard manure that could be utilized therefrom. Burns in a recent Memorandum[1] estimates the total production of 'green' or fresh manure at 839·5 million tons per year from the cattle population (including buffaloes) maintained in British India alone; and allowing for two-thirds of the above being used for fuel purposes, he estimates that about 279·8 million tons, containing 40 per cent dry matter, are being used as manure. In view of the important role played by farmyard manure in agricultural operations in India, it would appear useful to examine the position a little more in detail, in the light of data and information available on the subject.

The two chief difficulties in the way of a proper assessment of the above matter are : (a) the incomplete census data regarding the total cattle and buffalo population of India ; and (b) the absence of satisfactory data regarding the average daily excretion of dung and urine by the animals kept by private farmers in India ; most of the available data relate only to Government farms maintaining well-bred animals and operating under exceptional circumstances.

### *Cattle population*

Sen in a recent note[2] has summarized the available data on cattle and buffalo population in different parts of India. He concludes that 'the total bovine population in British India and the Indian States as calculated from the 1935 and 1940 Census Reports, has declined from 208 million to 207 millions'. It is well known that due to the present scarcity of fodder and high prices for meat, a large number of animals have been slaughtered in the last few years and it would be safe to assume the present number of bovine population in India at about 200 millions.

From the relative proportions of buffaloes to cattle and of young stock to adults in both the categories given in Sen's note, it would be possible to construct a picture of the distribution of the cattle and buffalo population in India as follows :

TABLE I

CLASSIFICATION OF CATTLE AND BUFFALO POPULATION IN INDIA

| | Adults millions | Young stock millions | Total population millions | Total adult equivalents millions |
|---|---|---|---|---|
| Cattle | 114 | 46 | 160 | 137 |
| Buffaloes | 26 | 14 | 40 | 33 |

Taking the average excretion of dung and urine of young stock at about half the relative figures for adults, the total adult equivalents are given in the last column of Table I.

Burns adopts the standard figures of 40 lb. daily excretion of dung for adult cattle and 50 lb. per day for adult buffaloes. But the total production of concentrates and roughages produced in India is calculated to work out to only about 10 lb. per head of cattle per day[3] and the average live-weight of animals in India is estimated at about 600 lb., which is much lower than the average live-weight of animals kept abroad or on Government farms in this country.

Cattle in India are known to possess a higher capacity for digesting poor fodders than the well-fed cattle in other countries. Assuming that about 30 per cent of the dry matter of the fodder given is digested and that the balance of 70 per cent is excreted as dung and assuming an average moisture content of 10 per cent for the fodder given and 80 per cent for the dung produced, the average quantity of dung that would be excreted per adult cattle would work out to about 30 lb. per day. This figure is in consonance with the data obtained by the writer in Mysore State, in Bombay Province and in the Central Provinces. The average excretion of dung by an adult buffalo in India can be estimated at about 40 lb. per day. To the above must be added the excretion of urine per day and the small quantities (1 to 2 lb. per head per day) of waste litter that

[1] Technological Possibilities of Agricultural Development in India—Statement IV, page 116.
[2] *Indian Farming*, March 1944.
[3] Statement V of Dr. Burns' Note, loc. cit, pp. 108 and 117.

invariably gets mixed up with the dung or urine and goes to form farmyard manure. The quantities of waste material produced per head per day and their average chemical composition are given below :

TABLE II

QUANTITY AND AVERAGE CHEMICAL COMPOSITION OF CATTLE WASTES

| Waste material | Quantity of waste per head per day | | Average chemical composition on fresh material | | | | |
|---|---|---|---|---|---|---|---|
| | Cattle | Buffalo | Dry matter | Organic matter | N | $P_2O_5$ | $K_2O$ |
| | | | per cent | per cent | per cent | per cent | per cent |
| Dung | 30 lb. | 40 lb. | 20 | 16 | 0·25 | 0·10 | 0·15 |
| Urine | 15 lb. | 20 lb. | 8 | 6 | 1·0 | Trace | 1·5 |
| Waste litter | 2 lb. | 1 lb. | 90 | 80 | 0·5 | 0·15 | 0·75 |

## *Annual Production*

The data given in Tables I and II would now help us to calculate the total quantities of cattle and buffalo wastes produced in India per year and the total quantities of manurial constituents such as organic matter, nitrogen, phosphoric acid and potash contained in them. The results obtained are expressed in terms of millions of tons per year as under :

TABLE III

ANNUAL PRODUCTION OF CATTLE AND BUFFALO WASTES IN INDIA

| Waste material | Dry matter | Organic matter | N | $P_2O_5$ | $K_2O$ |
|---|---|---|---|---|---|
| | (all figures in millions of tons per year) | | | | |
| Dung | 177 | 141·6 | 2·212 | 0·885 | 1·327 |
| Urine | 35·4 | 26·6 | 4·425 | Trace | 6·638 |
| Waste litter | 45 1 | 40·1 | 0·250 | 0·075 | 0·375 |
| Total waste material (undecomposed) | 257·5 | 208·3 | 6·887 | 0·960 | 8·340 |

In view of the fact that the farmer at present burns away about two-thirds of the total quantity of dung in the form of fuel and does not take the trouble to collect the urine properly, the raw materials used at present for farmyard manure preparation represent only about 59 million tons of dung (dry matter) and about 45 million tons of waste litter, making in all 104 million tons of dry matter per year, containing about 87·3 million tons of organic matter. Assuming that during the course of preparation of farmyard manure, about one half of the organic matter is decomposed, the total quantity of dry matter contained in the farmyard manure so prepared would come to about 60·4 million tons. At 50 per cent moisture level, the weight of the farmyard manure prepared would be about 120·8 million tons per year for the whole of India, including Indian States, which works out to about two-fifth of a ton of manure per acre of land under cultivation. I am omitting from the calculation the variable and sometimes large quantities of earth which often get admixed in the routine methods of farmyard manure preparation; but the earth so admixed does not possess any manurial value of its own.

## *Farmyard manure*

In view of the very serious difficulties existing in the matter of supplying an alternative fuel to the farmer in place of the cow dung he is burning, it is doubtful whether the quantity of farmyard manure that is prepared could be appreciably increased above the present level of about 120 million tons. The addition of extra vegetable refuse available on the farm and the adoption of composting methods may possibly increase the quantity of manure produced by about 25 per cent and raise the total figure to about 150 million tons for the whole of India, which would still be only half a ton per acre of land under cultivation.

The most hopeful way in which progress could be made would appear to lie in attempts at improving the quality of the farmyard manure by incorporating into it as much of cattle urine as possible. A reference to Table III would show that over 4·4 million tons of nitrogen present in cattle urine are at present being wasted as compared to 2·2 million tons of nitrogen contained in cattle dung. The work carried out by the writer has shown that it is possible to adopt simple methods of urine conservation which would recover at least 25 per cent of the urine nitrogen now wasted.

## *Nitrogen conservation*

The recovery of the above 25 per cent of urine nitrogen would mean as much as the addition of one million tons of readily available nitrogen to the soil, which would give us an extra yield of crop to the extent of at least 10 million tons of food grains, and would help to solve our present difficulties in the matter of food. This way would appear to lie an immediate and inexpensive scope for a more rapid improvement of our agriculture.

# What the Scientists are doing

## THE FLY PEST OF WHEAT (*ATHERIGONA INDICA*)

AT the Wheat Research Station, Powarkhera, in the year 1941-42, it was observed that the wheat crop sustained an appreciable damage on account of drying of young plants in considerable number. At first this was thought to be due to drought. The continued withering of wheat seedlings in spite of irrigation led to a close examination of the affected plants, which disclosed that some of them had a dipterous maggot at the base of the main shoot. In contrast to the damage by termites which occurs in patches or rows, the casualty on account of withering due to this pest was scattered over the plots. In cultivators' fields also it was observed that the wheat crop was affected to a varying degree. The pest was observed at other places of the province also viz. Damoh, Saugor, Mandla, Jubbulpore, Nagpur, etc.

The maggots were reared and the flies were identified as *Atherigona indica* Malloch belonging to the family *Anthmyiidae* order Diptera.

Observations on the pest in subsequent years revealed that it makes its appearance late in October or early in November when the wheat seedlings are two to three weeks old. The activity of the insect continues up to the end of December when the damage is restricted to secondary tillers and ceases with the fall in temperature. By the time the weather warms up again the crop is ready for harvest.

The off-season sown crop of wheat also showed a considerable amount of damage by the pest particularly in the month of September after the cessation of monsoon rains.

As regards the nature of damage, the maggot feeds inside the stem and when about to pupate lodges itself in the collar region. It may also pupate in the leaf-sheath of outer leaves. It does not however penetrate the collar region and enter the rhizome. As a result of the attack by the pest the entire plant dries due to the formation of deadheart.

The percentage of attacked plants varied from five to ten. Early sown crop showed greater infestation than that sown late. It was also observed that cultures belonging to *T. durum* spp. sufferred more than those of *T. vulgare* spp.

A reference to the record of this pest in Pusa, Coimbatore and Sind was made by Y. Ramchandra Rao in his paper on the Genetalia of certain *Anthomyiid* flies (*Atherigona* spp.) published in the *Report of the Proceedings of the Fourth Entomological Meeting held in February 1923.* But he has not made any mention of the economic aspect of the pest.

Further studies with regard to the life and seasonal history of the pest are in progress.

## ADULTERATION OF MILK

ADULTERATION of milk with separated milk is commonly practised in urban centres. As a rule it is very difficult to detect, as the very high percentage of fat in buffalo milk permits judicious admixture with separated milk to a considerable extent. It is, therefore, necessary to devise some simple method whereby the public can recognize without any difficulty such adulteration in genuine milk. Colouring separated milk with a distinctive colour appears to be the only means of achieving this end.

Studies have been carried out at the Imperial Dairy Research Institute to find out suitable dyes for colouring separated milk pink. Such dyes should no doubt be harmless to the human system. The results show that the following dyes, given in their order of performance, are quite suitable for this purpose: eosine, congo red, edicol erythrosine and cochineal extract.

In selecting the minimum concentration of the different dyes to be used for colouring separated milk, it is always to be borne in mind that its presence in genuine milk up to about 5 per cent should be detectable without any ambiguity.

The method of colouring separated milk is very simple. Assuming that it is required to colour 500 lb. of separated milk with eosin, 0·10 oz. of this dye is dissolved in 10 lb. of milk to be coloured. This lot is now added to the remaining milk and the whole mixed well. The separated milk is now suitably coloured as required and is ready for use. Similarly, for 500 lb. of separated milk, 0·15 oz. of congo red and 0·20 oz. of erythrosine are required.

It has also been found that these dyes do not impart any offensive flavour to the milk and such coloured milk is stable to heat. Further, the concentration of dyes recommended gives an appealing colour to the milk.

# What would you like to know?

*Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.*

**Q. Two samples of milk were tested and the following particulars were noted. We shall be glad to know the proportion of water that could have been added for adulteration ?**

| | | |
|---|---|---|
| 1. | Fat | 5·0 per cent |
| | Solid non-fat | 7·7 per cent |
| 2. | Fat | 7·6 per cent |
| | Solid non-fat | 8·2 per cent |

A. So far as is known at present, there is no single determination which gives more reliable evidence of the genuineness of milk than its freezing point. But from the legal point of view, samples falling below 8·5 per cent solids-not-fat are presumed to contain added water, unless the contrary is proved. Individual animals kept under the same conditions of care, feeding and environment will show considerable variation in the composition of their milk, some yielding milk falling persistently below the presumptive standards. In the absence of any circumstances usually associated with the giving of milk low in solids-not-fat (pathological condition, end of lactation, etc.) it must be assumed that the production of such milk is a characteristic of the individual animal in question. But the milk of a herd does not usually vary very much from the average.

As regards the particular samples mentioned, considering them as bulk herd samples it can be said that the minimum amount of water added is 9·4 and 3·5 per cent respectively for the two samples.

**Q. I have a fairly good quantity of whey and I want to make any product which can be placed in the market for sale. I have tried to make lactose by the following method :**

**I took some freshly drawn whey and heated it up to 90°C. and then strained out. In this way all small particles of casein were taken out and the clear greenish coloured whey was kept on heater in a water bath; thereby water of the whey was evaporated. The white residue was then powdered.**

**I have seen that the lactose which we get from abroad is clear white and without any smell. The lactose which I have made has got yellowish colour and has a smell of a peculiar type.**

**I shall be obliged if you will help me in this matter and let me know the correct process of lactose making, reagents for its decolouring, and books on this subject. Also please let me know if any other product could be made from whey for sale.**

A. In the preparation of lactose, the first crude product will always be coloured, since it is difficult to remove the last trace of mother liquor containing minerals and chromogenetic substances. This colour could be removed by a process called 'refining' which consists in redissolving the crude product in a minimum quantity of hot water and filtering the liquid to remove albumin, if any, and boiling for 10 minutes with decolourizing carbon (4 per cent of the weight of crude lactose taken). The liquid is to be filtered hot to remove carbon and then to be concentrated to the original weight of lactose. If this liquor is cooled for a day or two, fine crystals of lactose will settle at the bottom, which could then be filtered and washed preferably with rectified spirit to remove the last trace of mother liquor. The final product which is white can be dried either in the sun, or in a hot air oven at about 50-55°C. for about six hours. The other product which could be manufactured from whey is 'Lactalbumin' which is used for poultry feeding.

The following book which could be obtained from any standard book seller deals with the manufacture of lactose : *Condensed Milk and Milk Powder* by Hunziker.

# What's doing in All-India

## MADRAS

By Rao Bahadur V. Ramanatha Ayyar
*Deputy Director of Agriculture, Madras*

THE activities of the 'Grow More Food' campaign inaugurated in 1942 were intensified by giving the following facilities and concessions to the farmers:

(a) Twelve more irrigation schemes were sanctioned by Government with the object of supplying water to 14,000 acres.

(b) With a view to bringing 40,000 acres under cultivation in the Cauvery Mettur Project area of the Tanjore district special revenue, engineering and agricultural staff were sanctioned to investigate the causes of non-development of the area, to settle disputes, to provide further irrigation facilities and to do intensive propaganda for raising green manures on the reclaimed lands. Assessments on dry lands converted into paddy lands during 1943 and 1944 were waived. Some lands were assigned free of assessment (but subject to water rate) during 1943, 1944 and 1945. In other cases, water rate was reduced to Rs. 5 per acre for the first crop and half of that rate for the second crop raised on single crop paddy lands. No penalty would be levied for using water in prohibited areas for irrigating lands grown under food crops. Masonry works like syphons, culverts and foot bridges would be constructed at Government cost in this area. A sum of Rs. 30 lakhs had been set apart for the grant of loans to the farmers of this area for the reclamation of their lands. Such loans would be free of interest for one year and would carry 3 per cent interest in the next four years by which time the entire loan should be cleared. If the lands were reclaimed before September 1944 and a green manure or a paddy crop was taken from reclaimed lands, a subsidy of Rs. 10 per acre would also be granted to the farmers by the Collector.

(c) The powers of the District Agricultural Officers to grant loans were enhanced from Rs. 50 to Rs. 100. Loans granted by these officers for the cultivation of food crops on fallow lands or for the purchase of seeds and manures would be free of interest in 1944-45.

(d) About 4,32,843 acres were assigned to ryots for the growing of food crops in other districts.

(e) Intensive propaganda was done to reduce the area under non-food crops, and as a result some 82,833 acres were brought under food crops. In certain tracts the farmers were advised to grow food crops mixed with non-food crops.

(f) Water was allowed from the Periyar lake from 16 May to irrigate 10,000 acres of summer crops.

(g) More schemes for the rapid multiplication of seeds of improved strains of paddy and their sale to the farmers were sanctioned and a subsidy of 11 per cent of the cost would be allowed when the all-in-cost was higher than the market rate.

(h) Machinery was set on foot to conserve, to regulate and to control prices and to supply groundnut cake to the farmers. Besides, free supply of seeds and manures to the deserving poor ryots was made in each district to the extent of Rs. 100 in the case of the former and Rs. 2,000 in the latter.

(i) Arrangements were also made to stock and sell all kinds of manures in agricultural depots.

(j) Defectives of iron and steel were also stocked in the agricultural depots for distribution to rural fabricators and farmers. Iron and steel were also issued to approved factories for the manufacture of agricultural implements. The finished articles would be available for sale in the agricultural depots.

(k) A campaign for the consumption of more fruits was started in 1943-44. Four regional shows were arranged with Government subsidy, by local organizations or by leading growers. Several fruit products and fruit dishes were exhibited in the show and these attracted the attention of the public (see plate No. 43). As these shows were popular, they would be continued during the next year.

(l) A sum of Rs. 1 lakh was sanctioned for the sinking of wells in the ceded and Chittoor districts and another sum of Rs. 62,700 was allotted for sinking wells in six other districts.

### *Growing of vegetables*

Due to the phenomenal rise in the price of vegetables, there has been a great demand for the supply of their seeds. Arrangements were made to produce vegetable seeds on all agricultural stations and also to import from selected seedsmen from northern India. A central seed store was opened at Madras to cater for the needs of vegetable growers in and around the city of Madras. Special staff were employed to advise people to grow vegetables in all compounds and suitable places. To reduce pressure of military requirements on supplies to civil population more schemes were sanctioned in Chittoor, Salem and Coimbatore districts for direct supply to the military. Production was also stepped up in other schemes in operation. In the Nilgiris the daily supply of English vegetables was increased to 39,000 lb. The area under potatoes was extended in Madura and Salem districts.

### *Soil erosion*

With a view to taking effective measures against soil erosion, two officers—a District Agricultural Officer and an Executive Engineer —were deputed to Bombay Presidency to study the method adopted there for soil conservation and suggest measures suitable to this Presidency. Their report is under consideration.

### *Agro industries*

As a natural sequel to the investigations conducted in the laboratories of the specialists, a few industries have been either started already or are about to be started.

Production of malt from *jowar* which was started as a laboratory experiment some years ago has now become a commercial proposition. A factory has been established on modern lines. Three hundred pounds of malt food and 300 lb. of malt extract reinforced with shark liver oil are being manufactured daily for sale to the public.

Production of agar agar is another investigation which promises to become commercially important. It is a common medicine used for the artificial development of several micro-organisms in the laboratory. Japan had a virtual monopoly of the supply of this material to the world and since her entry into the war a shortage was felt throughout the world. Part of the demand was met from the U.S.A. and Australia. As those supplies were inadequate, great difficulty was felt for the manufacture of important vaccines.

To meet this shortage, investigations were taken on hand immediately by the Government Agricultural Chemist to manufacture agar agar from the sea weed *Gracilaria lichenoides*.

The method of the preparation as finally evolved by the Government Agricultural Chemist, Coimbatore, is simple and inexpensive. The dried sea weed, *Gracilaria lichenoides*, which is found in abundance along the east coast in shallow waters attached mainly to sand and coral rocks is washed free of sand and debris and soaked in 1 per cent hydrochloric acid solution for 15 to 30 minutes to remove encrusting and adhering calcium carbonates and washed in water until it is acid free. After bleaching and drying in the sun it is extracted in boiling water until the extract fails to jell on cooling. The extracts are combined and cooled to jell and the jelly so formed is cut up in small pieces, placed in a tall cylinder and roughly twice its weight of distilled water added, well mixed and left undisturbed for 48 hours after which the excess is strained through a muslin cloth. This process is repeated twice at an interval of 24 hours and finally the jelly is thoroughly washed and dried. The dried substance is agar agar.

The yield of agar agar thus processed is about 20 per cent of the dry weight of *Gracilaria lichenoides*. The setting power of this product has been found to be high excelling that of the standard 'Difco' brand of agar agar manufactured in Japan. Actual tests have indicated that the product is eminently suited for the successful cultivation of several unrelated kinds of micro-organisms such as yeast, *Aspergillus*, *B.coli*, *Lactobacillus*, mixed cultures from manure etc.

A detailed survey of the main sources of supply of alga *Gracilaria lichenoides* in the Madras province is under way. Proposals for the manufacture of this material on a pilot plant scale are under consideration.

### *Rubber from cryptostegia grandiflora*

A scheme was sanctioned by the Government of Madras for the collection of latex and plugs by the bleeding method from the plants growing wild near Bannur in Kurnool district and work was started recently.

***Ergot***

Mention was made in a previous note about the trials started for the production of ergot on the Nilgiris. Samples on analysis were found to possess high potency equalling the new B.P. standard. About 293 lb. of ergot were produced in the trials. Basing on the encouraging results a scheme for increasing the production of ergot was sanctioned by Government. It is proposed in that scheme to grow 70 acres of the rye in 1944, 250 acres in 1945 and 700 acres in 1946 with the object of securing ultimately 10 tons of ergot by October 1946.

***Production of yeast***

Production of yeast is another investigation carried out in the laboratory of the Government Mycologist, Coimbatore, which promises to be capable of being developed into an agricultural industry. The substances used for the production in the laboratory scale were an English culture of *Torulopsis utilis*, molasses, ammonium sulphate and super phosphate. The product has been pronounced to be good by experts. The Director General of Food, Government of India, has reported that the sample supplied by the Government Mycologist was satisfactory with regard to vitamin content and was pure yeast. It is proposed to set up a pilot plant. It may be mentioned that yeast is an extremely valuable auxiliary food especially in the absence of sufficient quantities of other protective food materials like milk, butter, ghee, eggs and vegetables to meet the requirements of the people. It has been hitherto chiefly valued for its contents of vitamin B complex. But recent work has shown that its protein and mineral values are equally important for human consumption and for supplementing the concentrates to milch cattle. Yeast protein is generally considered to be biologically complete containing all the essential amino acids and is declared to be as good as plant protein.

***Bee-keeping***

In the Madras Presidency natural facilities for the introduction of apiculture exist in a large measure in 20 districts. Intensive propaganda is, however, confined only to the districts of Vizagapatam, East and West Godavari, Nellore, Chittoor, Chingleput, North Arcot, Madras and Tinnevelly. In these districts special staff of bee-keepers and bee-boys are employed by Government to carry on propaganda and to assist persons interested in bee-keeping. They arrange for the supply of bee-colonies, hive boxes and other accessories for the marketing of honey. Due to the efforts of the staff, the number of private bee-keepers owning hives are gradually increasing in the above districts. In certain areas, special co-operative societies have been formed to market honey. Honey weeks are being celebrated in the districts to popularize the industry. As a result of these activities the quantity of honey made available for consumption has increased appreciably.

## BIHAR

By A. P. Cliff
*Special Officer, Grow More Food Campaign, Bihar*

OVER a large part of the province the rainfall up to 31 August, 1944 has been fairly good. But in certain areas, notably large parts of north Bihar and the north-western part of south Bihar, though there were good showers in early June to start sowings, the total fall in the three months has been seriously deficient. Consequently, although *bhadai* crops, chiefly maize and *marua*, promise very well, paddy transplantings in those areas are short and very late. The promising paddy crops of the rest of the province may be offset by these shortages.

Sugarcane, though on a somewhat reduced area, was in good condition at the end of the hot weather ; but the rainfall in the areas noted above has not been sufficient for full growth and the prospect of a full crop is now not quite so good. Co 513 is reported to be doing better in the north Bihar tract than Co 313, while in south Bihar Co 453 is reported to be doing better than the common variety Co 331. A very large demand for seed cane of Co 453 is expected which the Department is doing all it can to supply. The Sugarcane Varieties Advisory Committee at its meeting in August

released B 011 and Co 383 for coordinated trials in north Bihar and X1231 (B 021) for similar trials in south Bihar. There is considerable demand from both mills and growers for a big increase in the price of cane. Mills particularly fear a further reduction in the cane area in favour of food crops unless this is granted.

The marketing section continued its work of surveys and grading stations but is, of necessity, being drawn more and more into the work for increased food production and procurement. Both as a result of the organization created, and of the marketing information collected over the past 10 years, this section is proving of the greatest assistance in the present crisis. It can and does provide at short notice reliable information on any aspect of food production and collection required. In addition it has provided us most valuable direct assistance in the actual collection of vegetables for the Army in the Ranchi area, and in the large scale purchase of oilcakes for manure required for distribution by the Department all over the province.

With a general increase in food production consciousness, the Horticultural Section is proving more useful to the public. In addition to its work on regular bearing, manuring and cultural treatments of mangoes and other important fruits, it has started a Provincial Horticultural Society and is giving increasing assistance in vegetable production, supply of seeds, etc. to the general public.

Grow more food work is now getting on to a sound basis. A greatly increased field staff has been appointed and is at work. The distribution of paddy and other *kharif* seeds was lower than hoped for because, in the food circumstances of last spring, it proved impossible to buy back from growers the quantities of improved paddy seeds arranged for. Similarly there are very great difficulties and delays in getting wagons to move oilcakes for manures. But we have already in stock greatly increased quantities of *rabi* seeds, and manures are moving more freely. Also we have now received considerable allotments from the increased stocks of sulphate of ammonia that have recently become available. The better class farmers of Bihar know and appreciate the value of sulphate of ammonia; and in certain areas, notably the potato growing tracts of south Bihar, pay almost any price for it. One of our problems is to make them equally phosphate conscious and to find some way of supplying them phosphate as freely and cheaply as combined nitrogen.

Thanks largely to the recently sanctioned and appointed Departmental staff, progress in the execution of minor irrigation works has been greatly speeded up. Of more than 4,000 schemes sanctioned, 2,000 were reported to be complete before the rains stopped the work. These are estimated to protect from drought 4 lakh acres of rice lands and give increased production of at least 8 lakh md. of rice.

## ASSAM

By N. K. Das, L.Ag.(Hons.)

*Assistant to the Director of Agriculture, Assam*

SIR WILLIAM STAMPE, C.I.E., Irrigation Adviser to the Government of India, paid a visit to Assam in May last to advise on matters relating to water control (irrigation, drainage, embankments etc.) for crops. His detailed report since received indicates that by providing water control, an increase of 100,000 tons in the annual production of paddy could be adopted as a reasonable target in Assam. So far as provision of water control is concerned, the Public Works Department at present deals with all major projects, minor ones not requiring expert knowledge being dealt with by the Department of Agriculture, with financial assistance from the Government of India. The Department of Agriculture also provides power pump irrigation for the cultivation of spring paddy in areas where the winter paddy crop is precarious.

### *Sir William's recommendations*

Sir William Stampe recommends that 'subject to certain modifications, the minor works now being carried out, tentative and primitive as they must necessarily be, should be continued and expanded as likely to secure a substantial increase in yield by affording better control of water at critical periods of the crop'. He also considers that 'apart from their immediate 'grow more food' value, these works (including pumping) have also an important educative value in the villages'.

The Department of Agriculture has at present no Agricultural Engineer and has only an improvised engineering staff. It is therefore a matter of great satisfaction that the measures adopted so far by this Department in respect of water control for crops in rural areas has the approval of an authority like Sir William Stampe.

In addition to making suggestions for better execution of the work now being carried out by the Department of Agriculture, he has also recommended the appointment of a qualified Agricultural Engineer and other officers and staff in this Department. A similar recommendation has been made also for strengthening the Public Works Department.

In regard to irrigation with power pumps, Sir William Stampe says : 'Although it is doubtful whether rice irrigation by individually operated oil-engine-pumps is an economical proposition at times of normal crop values, an extension of the present experiment on more scientific lines is, however, advisable in order to ascertain both the true working costs and the increased yield of the crops benefited.' (It is to be mentioned here that with pump irrigation it is possible to grow spring paddy in areas where it is not usually grown at all). In view of this he has recommended replacement of unserviceable machinery and purchase of additional pumping sets.

### *Planning for post-war reconstruction*

The Provincial Government have set up a sub-committee (along with other sub-committees) to deal with post-war reconstruction in agriculture and forestry. The fact however remains that the actual detailed proposals will have to be formulated in the first instance by the Departments concerned. So far as agriculture is concerned there is reason to believe that the present 'grow more food' campaign is required to be organized on a comparatively long-term basis and in such a manner that it may be dove-tailed into the post-war development plan. The Department of Agriculture in this province, however, requires strengthening before the work of planning for long range developmental work can be undertaken. This question is receiving consideration of the Provincial Government. The possibilities of utilizing the culturable waste lands of Assam with a view to increasing food production would in particular require a detailed survey.

### *Grow more food*

The 'grow more food' schemes for 1945-46 are now under preparation and will shortly be submitted to Government. These will be more comprehensive than the schemes hitherto put under operation.

### *Exploratory stations for cigarette tobacco*

As a part of the all-India scheme for research in the production of cigarette tobacco, Assam is shortly expected to have two small exploratory stations, one in the Surma Valley and one in the Assam Valley. The Department has already got a few men trained for the purpose at Guntur with the financial assistance of the Imperial Council of Agricultural Research. If the preliminary work proves successful it is hoped that bigger schemes will follow and a very welcome agricultural development will take place.

### *Production of poultry, ducks and goats*

Apart from whatever schemes may be submitted for the 'grow more food' campaign in 1945-46, a separate scheme has been drawn up by the Department of Agriculture for increasing the production of small livestock in Assam. The question of financing this scheme is now receiving consideration.

### *General remarks*

The strain of maintaining local supplies for large Defence forces has been met to a degree which surprises all. A break in the monsoon during August however leads one to fear a reduction in the production of rice during the current year as the main winter crop will be affected.

## TRAVANCORE

By O. C. ZACHARIAH, B.AG.

*Manager, Office of the Director of Agriculture*

DURING last year manure scarcity was very keenly felt in Travancore. Oilcakes, bonemeal, chemical fertilizers are the manures usually employed in the State. But they are not produced or obtained in sufficient quantity to meet the requirements. In order to meet this shortage otherwise, Government have been pleased to sanction a scheme under

the 'Grow More Food Campaign' to manufacture compost manure with night-soil and town refuse on a large scale on up-to-date lines throughout the State in collaboration with the Imperial Council of Agricultural Research.

### *Compost production*

Accordingly a senior officer of the Agricultural Department was deputed to British India to get himself acquainted with the up-to-date technique of compost production. He was under training in Bangalore, Poona, Nasik etc. for six months under the Chief Biochemist of the Imperial Council of Agricultural Research and returned to the State early in January last. He was appointed as the Special Officer for the work and immediately arrangements were made for large scale compost production in all the municipalities and markets in the State. The sanitary inspectors of all the municipalities in the State were trained under the Biochemist for this purpose so as to enable them to start the work in each municipality on up-to-date lines. The training classes for sanitary inspectors of the municipalities in the southern and northern half of the State were conducted at Trivandrum and Alleppey respectively by the two Assistant Biochemists specially trained under the Biochemist. The trained sanitary inspectors would organize compost production in their respective municipalities under the guidance of the Biochemist and the Assistant Biochemists. Large scale compost production according to the present system has already started in Trivandrum and Alleppey and this system of composting has eliminated to a considerable extent the nuisance due to bad smell and intensive fly breeding which were being experienced according to the old system of composting. Arrangements are in progress to start the work in all the municipalities without further delay. The Agricultural Department is rendering all possible help to the municipalities in making the scheme a complete success. When this becomes an accomplished fact the manure problem facing the country at present will be solved to a great extent. This will ultimately aid the 'Grow More Food Campaign' in the State as it will decidedly promote the production of food crops in the country.

### *Cotton cultivation in south Travancore*

The soil and climatic conditions of south Travancore especially in the taluks of Thovala, Agasteeswaram and Kalkulam are eminently suited to the cultivation of cotton. The area that could be put under this crop in these taluks is about 20,000 acres. A local variety of cotton known as *nadan* is cultivated in scattered areas in these taluks. It is more or less a permanent crop lasting for a period of five years producing such a low yield as 100 lb. of *kapas* per acre per annum. The length of the staple is only about $\frac{3}{8}$ in. and the ginning percentage less than 25. In order to popularize better varieties of cotton among the ryots of these taluks, the Agricultural Department conducted some trial cultivations in the Aramboly Dry Crop Farm with some varieties of cotton of higher cropping power grown in British India. They were found to thrive best under the conditions obtaining there. Three exotic varieties namely Gadag I, M.A. II and Co.4 which are long stapled have been found to be most successful producing more than 500 lb. of *kapas* per acre and as such it is concluded that the cultivation could be extended to other areas round about with advantage. With this object in view, at the request of this Department, Government have sanctioned a scheme last year for the cultivation of cotton on 100 acres of land set apart from the forest reserve areas in south Travancore. The whole area was leased out to a prominent ryot in south Travancore for a period of three years subject to certain conditions, and the preliminary operations in connection with the cultivation were carried out towards the close of last year. The seeds required for the whole area were supplied from the Department free of cost on condition that the lessee would return after the harvest the seeds required by the Department to be supplied free of cost to other ryots so as to induce them also to take up this cultivation on cultivable waste lands. The whole cultivation was carried out under the control and guidance of the Department. Though the season was not quite favourable, the cultivation was a complete success and as soon as the crop was harvested, arrangements were made with the Director of Industries to dispose of the cotton to local spinners. Encouraged by the results of the first attempt, a number of ryots are now coming forward to take up the cultivation. It is understood that a big company is being floated to undertake this cultivation on a large scale with the help of Government. It is hoped that in the near future an extensive area of nearly 20,000 acres stretching from Aramboly to Cape Comorin belonging to various private parties which is left out as waste lands, will be brought under cotton cultivation.

### *Stockmen training*

Having regard to the paucity of qualified veterinary doctors, the services of stockmen in assisting the veterinary officers in the hospitals as well as in the field for propaganda work in connection with cattle improvement are very valuable. Necessity of appointing such men in the veterinary section was very keenly felt for the last few years. So the Government have been pleased to sanction the opening of a class for the training of veterinary stockmen, corresponding to the demonstrators in the agricultural section. The class was opened during the latter half of last year. In all 11 students were admitted to the class, of whom 9 completed their course and passed the test. As a larger number of hands are required now in connection with the post-war reconstruction plans already drawn up, arrangements are being made to continue the class for the next few years.

### *Control of cereal rust*

It has been observed that the rust diseases of wheat, barley and oat in India originate from the infected crop grown during April-September on the high ranges of the Western Ghats. The spores of fungi are blown to the plains in the direction of the prevailing wind during the south-west monsoon and they infect the crop grown in October in the plains. Thus both crops are affected. In order to control this disease and to save at least the October crop it became absolutely necessary to suspend the cultivation of these crops in high ranges during April-September. Realizing the importance of this, Government have issued a notification prohibiting the cultivation of these crops during this period, and accordingly the Divisional Agricultural Officer and the Agricultural Range Inspector of the locality carried out a vigorous propaganda in this direction among the wheat cultivators of high ranges. It had its full effect and the cultivation was completely suspended. A thorough clean up of the area was carried out during the closed period. All these works were carried out in collaboration with the Imperial Council of Agricultural Research.

## MILK RECORDING NEWS

RECORDS for lactations completed during July 1944 have been received from five of the village milk recording centres. Thirtysix cows and forty buffaloes completed their lactations during the month averaging 2,665 and 4,246 lb. respectively. Records for individual breeds are as follows :

### *Hariana*

Beri, Rohtak district, Punjab : Nineteen cows completed their lactations during July 1944 averaging 3,305 lb. The maximum yield was 5,947 lb. and the minimum yield was 2,392 lb. Selected records are as under :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| CH. 5 | Bacha S/o Sahia | 2 | 3.8.43 | 325 | 3,825 | 20 |
| CH. 8 | Hari Singh S/o Japli | 5 | 22.8.43 | 334 | 3,854 | 22 |
| CH. 11 | Shoenath S/o Udey Singh | 2 | 21.8.43 | 335 | 4,071 | 22 |
| CH. 1 | Sarup Singh S/o Hari | 6 | 21.8.43 | 335 | 5,947 | 22 |
| DL.269 | Hasti S/o Jota | 4 | 19.8.43 | 337 | 4,695 | 24 |
| RT. 8 | Dharam Singh S/o Bhola | 4 | 29.10.43 | 255 | 3,240 | 18 |
| BR. 25 | Sardara S/o Tota | 7 | 1.10.43 | 289 | 3,723 | 21 |

### *Kankrej*

Area Sanand, Ahmedabad district, Bombay : No cow completed a lactation under record during July 1944.

### *Local cows - Trivandrum, Travancore*

Five cows completed their lactations during the month averaging 2,367 lb. with a maximum yield of 3,900 lb. and minimum yield of 717 lb. The records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Date of drying | Milk yield in lb. |
|---|---|---|---|---|---|
| T.R.122 | Chellappan | 5 | 15.10.43 | 2.7.44 | 3,900 |

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Date of drying | Lactation yield lb. |
|---|---|---|---|---|---|
| T.R.187 | Mrs Thomas | 1 | 15.10.43 | 2.7.44 | 3,120 |
| T.R.283 | Gowrikutty Amma | | 24. 8.43 | 3.7.44 | 2,800 |
| T.R.285 | T.A. Motha | 1 | 17.10.43 | 4.7.44 | 1,300 |
| T.R.295 | B. Kaliyani Amma | | 9.12.43 | 2.7.44 | 717 |

### *Local cattle*

Chata area, Muttra district, United Provinces: Twelve cows averaging 1,776 lb. with a maximum of 2,822 and minimum of 1,190 lb. completed their lactations during July 1944. Selected records are given below:

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 3 | Rajaram | 2 | 20.8.43 | 336 | 2,822 | 14 |
| 61 | Parma | 3 | 6.9.43 | 303 | 2,465 | 12 |
| 24 | Chhajan | 2 | 6.10.43 | 276 | 2,318 | 12 |
| 12 | Bhima | 2 | 10.9.43 | 270 | 2,272 | 11 |

### *Murrah buffaloes*

Meham area, Rohtak district, Punjab: Twenty-three buffaloes completed their lactations during July 1944 averaging 5,103 lb. with a maximum yield of 7,440 lb. and minimum yield of 3,882 lb. Selected records are given below:

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. |
|---|---|---|---|---|---|
| ND. 205 | Dhan Singh S/o Mogni | 3 | 1.9.43 | 305 | 5,398 |
| ND. 327 | Sirdara S/o Bhalloo | 1 | 17.8.43 | 328 | 6,097 |
| ND. 335 | Jwala S/o Shan Datt | 3 | 1.9.43 | 329 | 5,322 |
| MA. 212 | Matu S/o Dani | 4 | 3.6.43 | 390 | 7,440 |
| MA. 4 | Balkishan S/o Laji | 3 | 15.10.43 | 252 | 7,000 |
| MA. 157 | Daoud S/o Alla Din | 2 | 6.10.43 | 320 | 6,528 |
| MM. 29 | Ishaq Mohd. S/o Nazirbuksh | 6 | 3.8.43 | 301 | 6,049 |
| MM. 155 | Shau Singh S/o Ju Sukh | 4 | 3 8.43 | 348 | 5,220 |

### *Local buffaloes*

Chata area, Muttra district, United Provinces: Seventeen buffaloes completed their lactation during July 1944 with an average yield of 3,086 lb., highest and lowest yields being 4,437 lb. and 1,873 lb. respectively. Selected records are as under:

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 162 | Ramprashad | 3 | 2.8.43 | 355 | 4,437 | 15 |
| 2 | Rajaram | 3 | 10.6.43 | 396 | 3,485 | 14 |
| | Phulsingh | 1 | 5.8.43 | 331 | 3,552 | 16 |
| | Rupram | 4 | 8.8.43 | 348 | 3,550 | 16 |
| 296 | Jiwan | 4 | 3.8.43 | 350 | 3,332 | 14 |
| 237 | Khubi | 5 | 28.8.43 | 311 | 3,245 | 14 |
| 60 | Ghisa | 3 | 3.9.43 | 304 | 3,375 | 13 |
| 279 | Mashoke Ali | 2 | 1.7.43 | 384 | 4,427 | 17 |

## ZEBU AS POSSIBLE DAIRY CATTLE

When Dr R. B. Kelley, of the Council for Scientific and Industrial Research, visits the United States, which he will shortly do, he will study the latest developments in Zebu herds, experiments with which are being conducted in Australia. Present Zebu experiments in North Queensland are related to beef production, but Dr Kelley is reported to see no reason why a dairy type of Zebu could not be produced just as readily as a beef type. He has no doubt but that selected stock will equal other breeds for butter-fat and total milk yields, with the added advantages of tolerance to high atmospheric temperatures, tick and other external parasites. He holds that the tropical east coast of Australia, particularly the wetter parts, is a potential dairying area.—*The Australian Dairy Review*, July 21, 1944.

# RESTARTING AGRICULTURE IN DEVASTATED EUROPE.

By Sir John Russell, F.R.S.

NEVER before in the whole history of mankind could the people of Europe have had to endure such appalling sufferings as have befallen the occupied countries during the past three years. Poland, Belgium and Greece have suffered especially severely, but the other occupied countries only little less. Recent refugees bring accounts of widespread and growing malnutrition and deficiency diseases, children crippled by lack of essential foods, adults suffering from acute forms of tuberculosis, widespread malaria, typhus and other diseases : almost worse still, the populations crushed and made listless by hunger and rapidly sinking to a condition when they can no longer take much part in rebuilding their shattered lives.

Along with this increasing inability to recover, there has been an appalling destruction of the material means for recovery. Agriculture is largely thrown out of gear : the systems of farming and the rotations are upset. Transport, the twin sister of agricultutre, is being utterly disorganized : ships, barges, railway engines, trucks and lorries are being destroyed as quickly as they can be found.

The first need will be to send in food, and this must be done immediately the Germans are expelled from any region. The need will be so great that the utmost efficiency of distribution will be essential. Steps will be taken to assure supplies of food, but they could not possibly continue indefinitely and it will be imperative to restart the agriculture of Europe at the earliest possible moment in order first to augment and later to replace the efforts of the relief organization.

### *Crops needed*

From what is known of the food conditions in the occupied countries, it seems certain that the most serious shortage is in calories. Until these are available there is no point in supplying more vitamins; indeed, we are told that vitamins without calories might do more harm than good. Immediately possession of the land is obtained it will be necessary, therefore, to sow crops capable of yielding high calorie returns per acre ; the easiest and quickest to grow are cereals and potatoes. Pulses will be almost equally necessary to make up deficiencies of protein, for meat is likely to be scarce. The requisite cultivation can be quickly done by tractors if they can be shipped across, but the seed cannot be quickly produced ; it must be saved from the crop of the preceding year. Provision of seed has, therefore, to be made beforehand. Grain for seed must be selected with great care ; the germinating capacity must be good ; the varieties must be properly chosen and delivered always to the right localities at the right time, and there must be no mixing of varieties *en route*. But for food grains none of these precautions are needed ; one variety can serve as well as another, and germinating capacity is unimportant. There will, however, certainly be regions where war operations have led to destruction or consumption of what should have been saved for seed, or where normal supplies are unobtainable ; for these some provision from outside sources must be made.

It is, of course, imperative that varieties be suitable ; sources of supply must be selected where the climatic conditions are similar to those of the regions for which the seed is intended. Something can, let us hope, be drawn from Germany, Italy and Hungary, which normally supplied seeds to neighbouring countries. Sweden, a producer of high-quality pedigree cereal seed, could supply Norway, Denmark and Poland, Great Britain can furnish wheat, oat and potato seed to Holland, Belgium, France and parts of Poland, also some spring-sown cereal seeds to Norway, and seeds of vegetables and fodder crops to various countries ; North Africa could supply wheat to France and Greece ; Turkey could supply wheat, barley and oat seed to Greece.

Potato seed is likely to cause trouble ; the only countries with any to spare may be the United Kingdom, perhaps also the Netherlands and Poland, unless the hunger in that tortured country becomes too great. But the storage

of potato seed needs care, and disease may spread in the Continental stocks, in which case the United Kingdom becomes the sole reserve.

### *Livestock problems*

Much more difficult problems will be presented by livestock. Before the War, Europe was comfortably well off, for livestock-farm animals, without counting poultry, were nearly as numerous as human beings. In the occupied countries there were in the aggregate 44 million cattle, 34 million sheep, 10 million goats, 27 million pigs, and 10 million horses ; 125 million in all for a human population of 137 millions. The numbers of cattle and of pigs generally ran in the same order as the numbers of human population ; in most countries, as in the average of all, there was one head of cattle to three or four human beings, and one pig to about five : Denmark had more, having a very large export of dairy produce and bacon, and Greece had less but made up with sheep and goats. The numbers in Great Britain corresponded with these when allowance is made for the fact that they provided only about 40 per cent or less of our food. This similarity of cattle population would not mean similar standards of life. Western European countries imported far more feeding stuffs than Poland and the Balkan countries, and so had a much larger margin for themselves, even after the export demands were satisfied.

It is impossible to form any close estimate of the present numbers of livestock, but piecing together the fragmentary information available it appears that by the middle of last year the loss of cattle alone was probably not less than eleven million head—nearly one and a half times the total cattle population of the United Kingdom, or a quarter of the pre-war cattle population. The losses had apparently fallen heaviest on Greece and Poland ; so far as could be judged, their numbers were down by about a third or a half. Denmark appeared to have suffered less than most of the others.

It is certain that the position has deteriorated a good deal since the middle of last year. Moreover, these figures, grave as they are, do not tell the whole story. It is the best animals that have gone. The loss of sheep has been as great as the loss of cattle over the whole area ; that is, about 11 million head ; but it has fallen with peculiar harshness on the people of Greece and of Jugoslavia, where sheep were important as the source of milk. The loss of pigs has been even heavier ; by the middle of last year the total numbers in the occupied countries were down by at least 12 million – half the pre-war total — and the fall is certain to be greater now. The reduction in horse population has also been severe owing to heavy requisitioning for the German Army. Poultry have suffered most of all ; by the middle of last year the numbers were only about one quarter the normal, and the position is certainly worse now.

Restoration of the animal population will be slow and laborious, and cannot be attempted until food supplies are in sight : one of the mistakes made after the war of 1914-18 was to send animals before the food was ready for them, and so they simply had to be slaughtered. After food for the animals is assured, milch cattle must be among the first to be increased so as to start making up the very great shortage of milk. Something can be done by supplying more and better food to the surviving animals, for the output of milk increases, up to a point, with the increase in food supply. But this will not suffice. Importation of live animals would be a solution if it were practicable.

But however carefully it is done, it seems unlikely that the cattle population of Europe can be restored in less than about six years. During the whole of this time, dried milk and other dairy produce will have to be sent into Europe. The restoration of the horse population will take much longer because the difficulties are greater. Germany could restore any requisitioned horses that survive : the United States could probably supply Percherons if transport was available. During the first year it will be imperative to do much cultivation by tractor, though, as every farmer knows, the tractor does not altogether replace the horse for general farm work.

Under good conditions the sheep population should recover more rapidly than the cattle, but in poor and hard conditions such as will certainly obtain in south-eastern Europe, recovery is bound to be slow ; it has been estimated as at least nine years. Pigs, however, multiply much more rapidly ; a good sow can produce and rear ten or fifteen piglets in a year ; in spite of the drastic reduction we need not assume more than two years as the time needed for restoration to pre-war numbers.

Certain administrative actions will facilitate matters. Immediately the Germans are expelled from any region it will be necessary to

control the slaughter of animals and to forbid the slaughter of female animals suitable for breeding and milking, and some at least of the working bullocks, if possible, however, bringing in some compensating amount of meat. The distribution of feeding stuffs will need to be regulated, and the veterinary services must be put into operation.

The immediate starting up of agriculture is only a small part of the task. Agriculture is a long-term business; the farmer must know not only what he is to grow this year but also what the year after, and the year after that. So it is necessary to think ahead beyond the first-aid period and to decide what is to be the object of the agriculture. In the first year it must produce calories. But is that to continue permanently ? There are two purposes at which European agriculture might aim: highest standard of nutrition for the people ; or maximum degree of self-sufficiency for the country or group of countries.

### *Choice before Europe*

The choice before Europe after the War will be self-sufficiency, or high standards of nutrition. In a self-sufficing Europe the inhabitants restrict themselves to what they can produce and go without the rest, or accept instead products for which one must use the German name *Ersatz* because the English language does not possess a sufficiently disagreeable word. Already the Germans have reorganized agriculture in the occupied countries on this basis, aiming at calories rather than protective foods. Grain and potatoes have replaced the more specialized and lucrative livestock products and fruits of the western countries, Holland, Belgium and Denmark, bringing great distress on their farmers. If this were continued after the war it would impoverish not only Europe but the primary producers also. Even prior to the War there was considerable over-production of calories in relation to the demand, and this had led to such pitiful results as the burning of wheat in some regions, while others, for example Italy, were suffering from shortages which a policy of self-sufficiency forbade them to satisfy. Representatives of the occupied countries now in Great Britain have expressed their views at conferences of the British Association, Chatham House and elsewhere, they reject the idea of a self-sufficing Europe ; they do not want this low standard of life and they recognize that it leads to chaos, even to war. They prefer to aim at the highest possible standard of nutrition : the phrase 'freedom from want' has reverberated through Europe, and aroused among its stricken people hopes and desires that we, who have never suffered as they, can only dimly apprehend. But this policy of abundance means that each region must produce the foods it can grow best, and exchange its products freely with other regions : there is no place for restrictions on trade in food. It is, in fact, the old policy of 'peace and plenty' that Bright and Cobden advocated so long ago.

Another decision must also be taken. What is to be the pattern of country life in Europe after the War ? Before the War, most of Europe's agricultural land was in small holdings, though there were large estates in Poland, Hungary and elsewhere. Russia, on the other hand, has gone in for large farms. In commerce and industry the large unit has obvious advantages and has in fact eliminated many of the smaller producers. It has been urged that we now have the chance of reorganizing European agriculture and should do it on the basis of large farms, not of small ones.

There would, of course, be a strong case for large farms if Europe were adopting the New Order and going in widely for grain production, this being well adapted to big-scale operations and to heavy mechanization. But the production of protective foods, involving as it does numbers of animals of various kinds, is well suited to the small farm.

Representatives of the occupied countries have stated very clearly that they do not want large farms, whether privately owned, State owned, or collective. They admit that some of their large farms have been very productive ; some of the Polish estates, for example have been not only efficient producers but also their homes have been delightful centres of Polish life and culture. But the majority prefer the smaller holdings. So agrarian reform has for some years been busy breaking up these big estates into small peasant holdings. Even where the management has thereby become less efficient, the social advantages are considered to outweigh the economic disadvantages. There is a big peasant population for which provision must be made. Industry is not far enough advanced to absorb large numbers, and emigration is probably out of the question. Also, there is very real land hunger, the innate desire to own a piece of land—usually a

particular piece of land. In eastern Europe this has even become a line of political cleavage, and strong Peasant Parties exist in Poland, Czechoslovakia, Jugoslavia and elsewhere.

In the past, the financing of the farm and the buying and selling of the produce have been major difficulties in the life of the peasant. The money-lender and the middleman—whether they were one and the same or different individuals—have often made the peasants' life a burden. Marketing of produce has always been a wasteful procedure ; the bulky material has been sold to a middleman and the small stuff taken by the women to market and there sold for whatever it would fetch—a time consuming operation which, however, was very sociable and clearly enjoyed by the women. These and many other difficulties can be got over by cooperation and I am firmly of opinion that the solution of the problem of holdings lies in the development of a strong cooperative movement.

On all grounds—economic, political and moral—we must in the reconstruction of Europe render all possible help and continue to play our part in the years of peace to which the nations are looking forward with such ardent longing.—*Abstracted from Nature*, 17 April, 1943.

## HOME GROWN RATION FOR LAYING HENS

POULTRYMEN who have well-cured second cut alfalfa, a reasonable quantity of skimmilk or buttermilk and home grown grains can make up an economical ration for laying hens which will give good results. By using such a ration only a minimum of purchased feed ingredients need be used.

H. H. Jenkins of the Dominion Experimental Farm, Nappan, states that excellent results have been obtained at the farms with the following feed mixtures :

Scratch grain consisting of two parts by weight of wheat and barley to one of oats. A mash mixture composed of five parts of coarsely ground oats, four parts of coarsely ground wheat and two parts of coarsely ground barley. To this ground grain mixture is added $1\frac{3}{4}$ per cent cod liver oil and 1 per cent of common salt, these being the only purchased ingredients in the mixture. The amount of cod liver oil used varies from the above proportion depending upon the vitamin potency of the oil available.

The mash mixture was before the birds at all times and was also fed occasionally as a wet mash. The grain was fed in the litter morning and evening in such quantity that a ratio of two parts of grain to one of mash was consumed throughout the fall and winter and equal proportions of the two during the spring and summer. Skim milk was given daily as a beverage at the rate of 40 to 50 lb. per 100 pullets excepting in the warm weather when this amount was reduced by half, water being then given to drink as well as the skim milk. Steeped alfalfa leaves were fed every second day as much as the birds would clean up in ten minutes, until fresh green grass was available in spring and summer. Oyster shell was available in hoppers at all times.

Over the three years during which this comparison was made the birds on the home mixed ration, fed as outlined, produced slightly more eggs than the comparable birds on a commercial mixture considered to be typical of those generally fed in the area. It may be taken for granted that the home grown ration was at least the equal of the commercial mixed ration used in this instance. The important consideration is, of course, that most of the ingredients of the home mixed mash were home grown.—*Department of Agriculture, Canada.*

## PENICILLIN AND THE DAIRY INDUSTRY

WHEN Dr Alexander Fleming discovered penicillin at the University of London in 1929, he gave medical men their most effective weapon against a number of diseases —especially septicemia and gonorrhea. Now, it appears, he also gave our dairy industry an opportunity to expand output of one of its products and thus make more efficient utilization of existing milk supplies.

The mould Penicillium notatum, which secretes the substance we call penicillin, grows in a culture of lactose or milk sugar. With production of penicillin now only a small fraction of what it ultimately will be, the demand for lactose undoubtedly is scheduled for a very sharp increase. A considerable increase in demand already is apparent. In 1942 approximately 7,500,000 lb. of lactose were used in the United States—about, 3,200,000 lb. in baby foods, 2,400,000 in 'pharmaceuticals', and the remainder in various miscellaneous food and

non-food products. In 1944 it is estimated that about 5,000,000 lb. of lactose will be required in the manufacture of penicillin alone. Total demand for all uses is estimated at a minimum of 12,500,000 lb. and might be as high as 14,000,000. That raises the important question : Will we have enough lactose for essential needs ?

New processing plants are being installed, and it is expected that total production in 1944 will be about 10,500,000 lb.—leaving a deficit of at least 2,000,000 lb. The Food Distribution Administration is considering various methods to assure the best use of available supplies and has requested the National Research Council to investigate the various uses of lactose and to establish a list of priority uses. Lag in the production of lactose is expected to be only temporary, however, since potential sources have not been utilized to their fullest extent. In 1942, about 1,365,000,000 lb. of whey were a by-product of casein manufacture. On the basis of a $2\frac{1}{2}$ per cent yield of lactose, the potential supply from this single source of whey is about 35,000,000 lb. This is well over twice the estimated need for 1944. There is also the possibility that quantities of unused whey resulting from the manufacture of cheese could be used for lactose. The process of making lactose from cheese whey is relatively simple and could be set up in many cheese factories which do not have a commercial outlet for whey at the present time.

It is possible that some other culture medium with properties superior to lactose might make its appearance ; science is exploring every possibility for increasing output of penicillin. But the way it looks now, the use of lactose in the preparation of penicillin is a development the dairy industry should watch with keen interest.—*The Australian Dairy Review*, May 20, 1944.

## QUICK FREEZING IN AUSTRALIA

A quick freezing plant will very shortly be in operation in Sydney, and will be freezing appreciable quantities of vegetables to meet special service requirements. Plans are being developed by commercial interests in the food processing field for the commencement of quick freezing on a big scale as soon as conditions permit, and it is certain that the quick freezing industry will soon become firmly established in Australia.—*The Agricultural Gazette*, 1 October, 1944.

# New Books and Reviews

## HOW TO PRODUCE MORE FOOD

By KHAN BAHADUR NIZAMUDDEEN HYDER (1944, pp. 49, As. 12).

KHAN BAHADUR NIZAMUDDEEN HYDER'S booklet on '*How to Produce More Food*' is a useful publication and should find a wide circle of readers. The mainstay of his programme is an extension in the present area by bringing culturable waste lands amounting to 15 crore acres or two-thirds of the area actually sown, under cultivation. Small pieces of land not exceeding hundred acres available in most villages can and should be developed by local enterprise. The problem of breaking up the large tracts in the sub-montane districts is probably not as easy. Besides costly works, to improve drainage and thereby render the area fit for human habitation, the problem of labour is a serious one but can be solved only when mechanical means such as tractors are utilized for breaking up the land.

A substantial part of the culturable waste land in United Provinces as elsewhere can be utilized for food production by providing irrigation and drainage facilities as well as bunding. It is suggested that reclamation of Usar areas should be started immediately and an Usar Reclamation Section established. Land owners should be either compelled to develop and cultivate the land on their own account within a specified period of time, or hand it over to those willing to undertake the job. According to him there is no dearth of capital, only it is shy of agriculture. The capitalists have done so much for the industrial and commercial development of India but so little for agriculture, the premier industry.

Measures for the prevention of soil erosion, drainage of water-logged areas, and construction of reservoirs and canals for irrigation should be undertaken by Government who should also take up large scale farming. Large scale cooperative farming is also advocated. It is rightly held that for the big task of extension, the existing staff and equipment should be augmented by the creation of a special Extension Branch in the Department of Agriculture to undertake a rapid survey of culturable wastes, barren lands, select lands which can be developed comparatively quickly, invite capitalists to organize large scale farming, arrange for land and the necessary labour, machinery and other equipment and render scientific assistance to ensure sound crop production.

Mr. Nizamuddeen Hyder overlooks however the importance of increasing acre-yields of food crops growing on the existing area. Crop yields in India are notoriously low chiefly because the cultivator has not, in the past, found it economic to invest in manures. With the high prices of food grains this should be possible. Measures taken piecemeal, however, are not likely to achieve the goal. Crop planning on an all-India basis is the first desideratum. Drastic steps should be taken to ensure the optimum standard of acre-yields. Minimum standard of manuring, commensurate with the available irrigation facilities, should be enjoined on the cultivator. A stage has reached when the time-worn policy of persuasion and propaganda should give place to compulsion with the object of securing the maximum output of food and fodder crops to meet the ever increasing civilian and military needs. As the *Daily Telegraph* puts it, every Government in India ought clearly to substitute a not inconsiderable 'Dig for Victory' campaign into a 'Manure for life' campaign.—S.I.A.

## THE KEEPING OF POULTRY IN INDIA

By A. E. SLATER (Thacker Spink & Co., Calcutta, Rs. 2-8).

THIS little book will be found very useful to all those who are keeping poultry or are about to keep poultry for the first time. Such people are daily increasing in number; the present scarcity of eggs and poultry meat and the increased realization of the important part which these commodities can play in the human diet have induced the desire in many to acquire the number of hens necessary to provide them and their families with a constant supply of good fresh eggs. This book tells them how to do it. It is written by a man whose practical experience of poultry keeping in India must be unique. He knows what ought to be done and what ought not to be done, what can be done

and what cannot be done and in a clear simple manner puts it down in black and white. Every important practical aspect of the subject is dealt with ; the selection of the stock, its housing, feeding, management, hatching and rearing, prevention of disease and the maintenance of health. What makes the book most valuable is the realization that the advice given on each aspect of the subject is not the outcome of exotic knowledge but is based upon what the author during a life time of practice in India has learnt to be sound.—G.W.

## PROTECTION OF TIMBER FROM BORERS

HOW can timber be protected against the attack of powder-post beetles ? The Forest Research Institute, Dehra Dun, suggests two methods in a leaflet just published.

A mixture of creosote and fuel oil applied externally prevents attack for at least nine months and probably for much longer.

A coating of lime wash gives complete protection over a period of three months when liability to attack is serious. Provided the coating is kept intact, it is expected that the protection would become permanent. This is however suitable for timber protected from rain. The addition of some sticking agent to lime wash will make the treatment effective for external structures.

The Institute claims that the treatment suggested would give at least temporary protection in cases where the standard treatment—impregnation with preservatives—cannot be applied. The treatment, however, must be given within a short period of cutting or sawing.

### ERRATA

INDIAN FARMING, Vol. V., No. 9, September 1944 :

1. p. 392, line 6 :
   *for* 'Col. G. B. Houell' *read* 'Col. G. B. Howell'
2. p. 414, col. 1, line 19 :
   *for* 'demage' *read* 'damage'
3. p. 419, col. 1, line 2 :
   *fro* 'i corporates' *read* 'incorporates' line 8 :
   *for* 'sat' *read* 'slat'
4. p. 421, line 18 from the bottom :
   *for* 'It is reported it would be' *read* 'It is reported and it would be'

# From All Quarters

## A MODEL FARMER

THERE are ryots in the Ramnad district, Madras, who play an important part in making the Grow More Food campaign a success and Dakshinamoorthy Pillai of Kollangudy (in Sivaganga *taluka*) is one of them. Even in pre-war days of economic depression he was having a well-balanced system of cropping giving more importance to food crops like paddy, millets and vegetables than to commercial crops like cotton and groundnut. He is a self-made ryot of the middle class, having risen to the position of the Headman of the village to whom all the local disputes are referred for amicable settlement.

He owns about 60 acres comprising of 20 acres of wet lands, 10 acres of intensively cultivated garden area and 30 acres of rainfed dry lands. Realizing that cattle wealth has a direct bearing on the fertility of the land he has been devoting much attention to feeding and rearing of cattle. His present herd is 28 heads strong and a flock of sheep. The dung and urine are collected and conserved in pits in a scientific way. He has his own green manure seeds of *kolinji* and *daincha* and he raises excellent green manure crops and incorporates them into the soil. His manure bill is almost nothing.

Having realized that good seed is as important as proper manuring for obtaining maximum yield from lands he has taken pains to see that his whole area is now covered by improved strains of paddy and millets. Bellary onions and vegetable seeds of improved varieties supplied by the agricultural depot are also cultivated. Invariably he starts the preparatory cultivation with mould board iron ploughs like Cooper 11 and finishes up with country ploughs.

The tract being mainly rainfed this ryot has dug and built of masonry three good wells to supplement the natural water supply. These wells also enable him to raise paddy nursery quite in time and keep the seedling ready for transplanting when water is received in tanks.

Details of the crops raised, cost of cultivation, value of produce and net income per annum are as given below :

*Wet area :* Paddy $Co_3$ in 15 acres and $adt._3$ in 5 acres.

*Garden lands :* *Cholam, cumbu* and *ragi* strains in 7 acres,

Chillies and vegetables including tomatoes and Bellary onion in 3 acres.

*Dry lands :* A. S. 29 *Cholam,* P.T. 8 *cumbu,* black-gram, and cow gram in 20 acres.

From the above cultivation he gets 460 *kalams* or 518 bags of paddy ; 122 bags of millets (*cholam, cumbu* and *ragi*) ; 46 bags of pulses (black gram and green gram); 8 maunds of Bellary onions ; 130 maunds of chillies and 60 maunds of vegetables including tomatoes. He does not hold up his stock of grains. In addition to the payments made to his field labourers in kind, he has been selling to the needy villagers all the surplus grain reserving just enough for his own family consumption. The following quantities of seeds have also been distributed by him to ryots in the vicinity during the year.

| | |
|---|---|
| Paddy seeds .. | 7,200 lb. |
| *Cholam ragi,* and *cumbu* | 1,280 lb. |
| Pulses .. | 760 lb. and a good lot of vegetable seeds. |

His economic condition has been very much improved by the high level of prices ruling now. He has been able to combine a hospitable outlook with frugal habits. His annual expenditure on 60 acres of cultivation comes to Rs. 2,700; household expenditure Rs. 2,000. (Total 4,700).

| | |
|---|---|
| Value of produce from the land (not including the income from sale of stock) | Rs. 6,970 |
| Net saving per annum | Rs. 2,270 |

He is a leading ryot of the tract whose resources are always at the disposal of the villagers. For running a model farm and serving as a reliable seedsman Dakshinamoorthi Pillai was awarded a prize last year from the Collector's discretionary grant, which he has so richly deserved.

## CRIMINAL POISONING OF CATTLE

WE all are aware of 'Sui' poisoning in cattle which produces lesions almost like Black-Quarter. In my tour in the Bhavani taluk, Coimbatore district, I had an opportunity of seeing a contrivance which the *madikas* make use of for killing cattle. The lesions produced in these cases are similar to Haemorrhagic Septicaemia. Here also like 'Sui' poisoning, the contrivance used is a stick.

Description of the stick: A curved strong stick about $2\frac{1}{2}$ ft. long which tapers towards one end. A sharp thin iron plate – a chisel – about $1\frac{1}{2}$ in. long and $\frac{1}{6}$ in. broad is fixed on the tapering end and tied strongly.

Technique: A corrosive fluid – *madar* juice – is smeared on the thin end, about a foot long, and the stick is thrust into the throat, after opening the mouth of the animal, the pharynx and larynx are lacerated, whereby the corrosive *madar* juice is injected into the wounds thus created.

Symptom seen in animals: Since this malicious injury is inflicted mostly at nights, the initial symptom is not usually noticed. Next morning the throat gets swollen with dribbling of saliva, at times blood-tinged. The animal goes off food and becomes suffocated. The tongue is protruded and the animal shows symptoms generally seen in Haemorrhagic septicaemia or malignant sore throat in cattle. The victims die of suffocation. The illiterate cattle owners, who know the symptoms exhibited in Haemorrhagic septicaemia, believe that they have died of this infectious disease. But the peculiarity noticed is that it is not of a contagious or infectious nature, for an animal dies in one shed and after four or five days another in a different shed or village, shows the very same symptoms.

During the month of September and October 1943, seven or eight cattle died in a similar manner in one or two villages in the Bhavani taluk. This was brought to my notice by a ryot who came to know of such a contrivance being used and who was able to give me a stick of the above description on my request. The stick on examination was found soiled and in addition smeared with a dried brownish-black pasty substance. This stick was said to have been used for the purpose. The scrapings of this pasty substance were sent to the Chemical Examiner to the Government of Madras, who reported as follows:

'We examined the brownish lump and powder and we obtained from them reactions indicating the probable presence of *madar* juice'.

This *madar* juice is commonly used by quacks for blistering animals. What I first suspected was the juice of cactus species which also causes blisters on the skin.—C. V. PADMANABHAN, *District Veterinary Officer, Erode.*

## *Degree for Dr Acharya*

WE are informed that the University of London have conferred the Degree of Doctor of Science (D.Sc.) on Dr C. N. Acharya, Chief Biochemist to the Imperial Council of Agricultural Research, for his investigations in the field of biological decomposition of organic materials, with special reference to the preparation of farm and town composts. We offer our congratulations to him.

## BUTTER ENGINEERING

CONTINUED manufactnre of butter, making the standard batch churn obsolete, has been perfected in Australia. Sweet cream is standardized for acidity at 40 per cent butterfat content and passed through a combination volatilizer and pasteurizer for vacuum pasteurization. Then the cream, held at 100 deg. F., is further separated to 82 per cent butterfat content in a Danish Titan separator of the foamless elevating type, after which it is forced through brine-cooled chilling rolls of spiral contour. This is said to 'shock chill' the hot cream and work it sufficiently to produce a continuous extrusion of butter. No air is left in, and keeping quality is said to be increased greatly.—*Food Industries*, Sept. 1944.

# INDIAN FARMING

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INDIAN FARMING

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# CROP YIELDS IN RELATION TO MANURING

MUCH has been said and written about the yield of crops in India. This varies greatly, in some places it is very low. Generally the low yield is conditioned by lack of two main factors, viz. water and plant food.

Where it has been possible to correct the lack of either or both of these essentials the yields in India, under intensive cultivation, have reached the high standards of other countries. Low yield is essentially not an inherent character of Indian agriculture. It can be overcome by improved agricultural practices.

The provision and distribution of water in suitable quantities and at the proper time has been much studied by both the Agricultural and Irrigation Departments and there is a good deal of information available on the subject.

The need for water is great indeed and has been suitably emphasized but the need for plant food or for manure is no less important. Yet it does not seem to have received equal attention and emphasis in Indian agriculture. The supply of plant food is largely a matter of supplying manure but this practice has not been very consistently carried out, partly owing to a lack of knowledge as to the nature and application of the required plant food and partly due to the cost of manures being too high to be compensated by the increased crop obtained. This particularly applies to nitrogen as a manure for food crops.

A major problem then is the provision of an adequate supply of cheap suitable manure to make its use a practical proposition to the cultivator; unfortunately this has not been forthcoming so far. This failure may have diverted the attention of scientific research workers towards improvement by other means, more particularly by the breeding of better or more efficient varieties of crops. The work already done in this direction has given such outstanding results that there has been and still is a tendency to concentrate scientific investigations along genetical lines. This is to be commended as far as it goes, though in spite of the success that has been obtained the use of the improved varieties by the cultivator is not as general as it should be and the position still maintains that though high cropping varieties are known, the old low yielding ones are generally grown.

It is necessary to ascertain why this state of affairs exists. Several contributory causes are responsible, e.g. paucity of staff for both research and development, insufficient demonstration in cultivated areas and insufficient organization for distribution of improved seed.

All these restricting factors must be put right but they do not seem to offer a complete explanation. There are notable cases where improved varieties of crops, e.g. sugarcane and cotton, have been eagerly adopted by the cultivator. Cases can also be cited in respect of cereals, such as wheat. The cultivator, therefore, is alive to improvement.

But a point in this connection that has not received adequate attention and which may well be an all-important factor in the adoption of the improved varieties, is the appreciation of the fact that for many years the land has been steadily cropped and has now reached a level at which crops are conditioned in yield by the capacity of the soil to provide the necessary plant food. The supply of mineral food depends on the soil and generally this is sufficient. Organic substances, such as vitamins and growth-promoting substances, can be planted into the soil through the organic mulch and are sufficiently controlled by methods of

agriculture. The capacity of the soil to produce a crop is regulated by its recuperative power or ability to absorb nitrogen. This is brought about by organisms, such as algae and bacteria, whose activities are greatly influenced by the soil condition. In order that these organisms shall flourish they must be supplied with carbon in the form of available organic matter derived from the crop residues and weeds. In the course of years a balance has been attained whereby the nitrogen obtained is nearly constant and closely related to the organic residue yearly added to the soil. If these organic residues increase, as might be the case with the more vigorous growth of a better variety, then the nitrogen fixing organisms will increase in number and virility, the recuperative value of the soil will increase and a higher crop can be maintained. With many crops, however, the increase in the form of both vegetative growth and seed is removed in the harvested crop and in the case of a cereal crop only a short length of stubble is left. This is not greatly increased by the use of the better variety, and hence nothing is added whereby the recuperative power of the soil may be augmented to meet the heavier drain on the plant food in it made by the higher yielding crop.

Improved varieties of crops as a rule require more food from the soil and this is removed with the harvest. A larger crop is obtained on the same land where the old variety has been growing simply by reason of the more efficient utilization of the soil nitrogen. For some time it will be possible to tap reserves in the soil that were not available to the old variety. Whilst such reserves last the new variety will continue to yield larger crops ; but, sooner or later, such reserves will be used up and if the nitrogen recuperative power of the soil has not been increased corresponding to the depletion of the resources the yield of the new variety will fall until it is in equilibrium with the nitrogen available. Thus, the crop obtained will be controlled by the recuperative power of the soil and not by the variety of plant grown. This has often happened and the fall in yield has been wrongly attributed to deterioration of the seed ; the real cause is starvation. The maintenance of high crop yields then is dependent primarily upon the food supply. If this is adequately maintained crop yields will also be maintained.

A main problem, therefore, of crop yields is the food supply of plants, chiefly nitrogen. This can be increased by improved agricultural methods, such as growing suitable leguminous crops which assimilate nitrogen from the air, by the addition of organic matter, possibly in the form of a greater amount of crop residues, and also by the direct application of manure to the soil. Whilst the first two methods must be adopted to their fullest efficiency under intensive agricultural conditions, the direct addition of nitrogen as a fertilizer also becomes a necessity. This is amply demonstrated in those countries which have adopted intensive methods. India has no reason to be considered an exception and for the production of a larger crop the primary requirement will be an adequate supply of plant food, particularly nitrogen.

This necessity for providing adequate food for the plant must be realized by the cultivator and whenever new and better varieties of seed are distributed to the public, the need for manuring also must be insisted upon. Otherwise failure is almost certain, there may be a reaction against the use of new varieties and agriculture may suffer a set back. It seems likely that the failure to appreciate this aspect of the agricultural problem has been largely responsible for the very inadequate utilization by the cultivator of the undoubtedly better varieties of crops that have been produced by the Agricultural Departments.

The problem of nitrogen supply is difficult, for cheaper crops, and food crops in particular, can afford to pay very little for nitrogen, the value of the increased crop often is insufficient to pay for expensive manures and manuring hardly becomes a practical proposition. In such cases provision must be made for the supply of cheap manures, in whichever form they may be available to replenish the soil with the necessary plant food.

# *Original Articles*

## EXPERIMENTS IN ALTERNATING HUSBANDRY IN SIND

E. A. Garland

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PERHAPS one of the most notable developments of war-time agricultural practices in England, setting aside mechanization, has been the greatly increased use of temporary grass leys. Sir George Stapledon has been the great advocate of this change, which is said to be proving highly successful in combining better fodder yields with improved maintenance of soil fertility. The fact that the popular Penguin series has published a book on Ley Farming, by Stapledon and W. Davies, provides some measure of the interest which is being taken in it. Grass seeds are sown either with or soon after corn and the temporary grasslands thus formed are retained for varying periods, between one and five years apparently, according to circumstances. Full utilization by close grazing has been found to be essential to obtain the best results. Obviously this change in farming methods in England must involve, to a varying extent, a break away from the old fixed rotations in cropping, by which each field was supposed ideally to follow a regular sequence of crops year after year, such as the famous 'Norfolk' four-course rotation, which had continued in use since first introduced in the 17th century. Since this adoption of 'alternating husbandry', as it has been briefly termed, has proved so successful, it is possible that adaptations or extensions of the same principle might be worthwhile in this country as well.

### *Alternating husbandry and soil fertility*

Grasses, considered as crops, are far more 'flexible' than arable crops. The latter have to be harvested every year as they reach maturity and their harvesting has to be followed by fresh cultivation and sowing in time for the next season. Such crops in fact are roughly annual. Grasses on the other hand, though they yield their produce each year, can continue without fundamental renewal by ploughing and sowing for several years. Their life as a crop, therefore, is of no definite duration, but may be curtailed or extended to suit conditions. This must make farm management more complicated, calling for greater forethought and good judgment, but at the same time may have certain advantages provided it can be organized to fit in with corn and other crop rotations all over the farm, so that the whole farm unit goes forward steadily on the basis of maximum productivity. By the method of alternating husbandry fertility of the soil is gradually built up by organic additions during the life of a grass crop, the final addition being somewhat like a form of green manuring when the grass crop is ploughed up. This stored fertility is then cashed by various crops and the same process of replenishment may be renewed. In other words the tendency, or an acknowledged need, is to integrate longer term grass crops with short term (annual) crops of corn etc. so that they are treated together as a single economic unit. Once this principle is conceded there is only a short and logical step to the experimental inclusion of other crops, even though they may take considerably longer time to mature than grass crops. The essential condition is the provision of alternating periods for soil recuperation to offset periods of soil exhaustion. The value of tree crops of certain species in soil improvement by additions to humus, etc. is well known. Also trees as young seedlings and saplings make relatively small demands on the soil in comparison with crops which mature more quickly. If such a tree crop could be arranged as an overlapping and supplementary crop with corn and grass, intercropped in its younger stages with corn and later with grass, it would not add to the demands of the former but should increase the utility of the latter. It should, therefore, theoretically qualify for consideration as an extension of alternating husbandry.

Obviously slow growing trees, such as teak, which require very many years to grow up are incapable of inclusion in any normal agricultural programme of rotations. But quick growing

species, which produce fuel and small sized timbers for agricultural uses, can be grown to rotations of 15 or 20 years periods that are not too long to come within the scope of normal human plans and ambitions. On this account, work already being done on these lines by the Forest Department in Sind gains added interest.

### *Dwindling fuel supplies of Sind*

To many people who are accustomed to think of Sind only as a desert it may be a surprise to learn that in normal times Sind not only supplied her local markets with fuel and charcoal, but in addition produced sufficient for a small but quite flourishing export trade overseas, up to the Persian Gulf as well as to other parts of India. Even in war-time, with much increased internal demand as well as reduced import of coal, Sind has been able, by strict control over internal consumption and over exports, to help her less fortunate neighbours to a considerable extent both with fuel and charcoal. Charcoal of prime quality is made from *babul* (*Acacia arabica*), which has been grown chiefly in the riverain tracts, on lands subject to annual inundations. Another source of supply has been *kandi* (*Prosopis spicigera*), a tree which will grow with a scanty rainfall, insufficient to support permanent agriculture; while *lai* (*Tamarix dioica*) which grows in swampy ground around the large shallow lakes, has also produced much useful fuel as well as brushwood and stakes useful for a wide variety of purposes. Roughly half the quantity and considerably more than half the value of this total production has been from Government forest lands, chiefly in the riverain tracts, the remainder being from zemindari lands. The surplus, however, has been slowly dwindling for many years, as irrigation has been developed to bring more and more land under cultivation. Demands also increased from an increasing population. This trend was somewhat mitigated by the practice of sowing the *babul* trees as a dense crop to reclaim land (known as *kalar*) impregnated with salts. Such land after thorough washing and a few years under the babul tree was found fit for agriculture after felling the *babul* crop. In recent years, however, the loss of equilibrium has been powerfully accelerated by the construction of the great Sukkur barrage. Infact the extensive system of canals constructed has drastically modified the whole ecological basis in this zone. The new conditions practically amounting to a changed climate, provide opportunities for proliferation of a much more varied flora and fauna than formerly. The exact range of species which may be capable of inclusion is still uncertain, but many of these may be potentially harmful just as easily as useful, unless most carefully watched and strictly controlled. It is just as easy to provide optimum conditions for *lantana*, cotton boll weevil or anthrax, for example, as for crops and stock useful to man. All these changes in conditions will also bring about powerful and not always very desirable reactions on the human inhabitants. The particular aspect with which the Forest Department has been concerned is that increased cultivation has meant increased demand for fuel and simultaneous decrease in sources of supply. There are plans materializing for more barrages. When these are built there is every likelihood that the annual floods in the Indus will be so controlled that much land formerly inundated will be left above the flood levels. This will affect a very large proportion of the Forest Department's estates, on which the province has relied in the past for its fuel supplies. With a simultaneous diminution or even disappearance of other existing sources of supply, and no other new ones being developed, the fuel position is very likely to be unsatisfactory.

### *Alternating for fuel production*

Food is of little value without fuel to cook it. Apart from the necessity for a flora, well balanced and capable of conversion into cash, a mere concentration on the production of the maximum quantities of grain and cotton without leaving sufficient land for fuel would be pointless. Everyone needs fuel but the average landowner does not want to grow it because it takes long to establish it on a profit-making basis. Even then it is not as remunerative as many other crops, besides needing a lot of land in order to yield a regular and sustained supply. It may be urged that in normal times better fuel in the shape of coal can be easily and cheaply imported. Recent experiences should, however, have shown the wisdom of arranging for at least minimum requirements to be produced locally. If this can be done and at the same time, through a system of alternating husbandry, soil fertility can be improved by organic additions, to such an extent that expenditure otherwise inevitable on organic manures can be greatly reduced, the proposition may well prove economically attractive. For India where good grazing is so scarce, the

FIG. 3. Cotton growing between lines of young trees

FIG. 4. Grown-up trees with intervening arable crops replaced by grass

PLATE 48

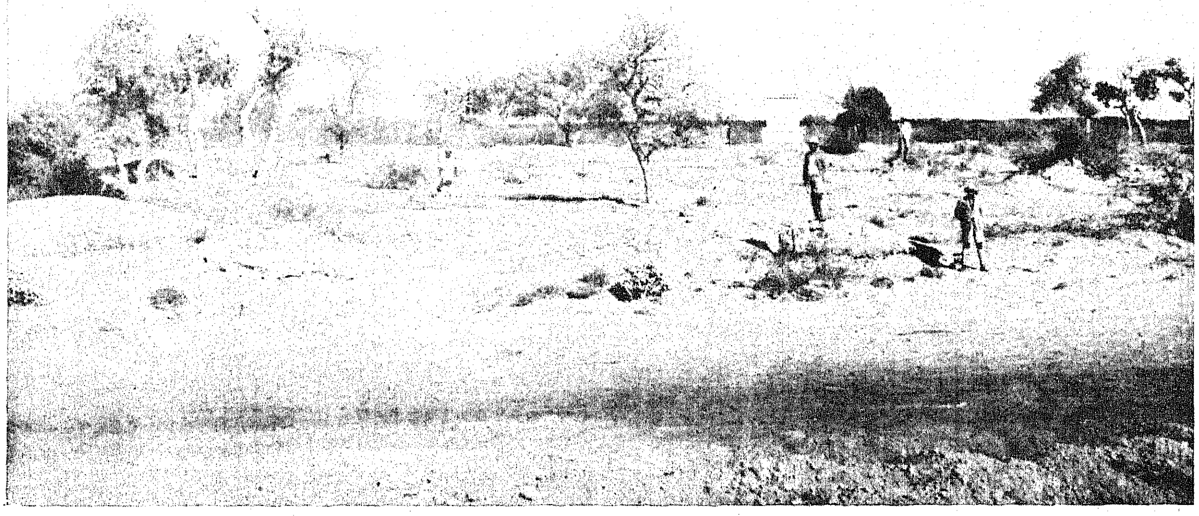

FIG. 1. Typical Sind land before reclamation

FIG. 2. Babul after one growing season with cotton

possibilities of a threefold alternation, in which tree crops overlap corn and grass crops, grass following corn for inter-cropping between lines of trees, should specially merit investigation. Nor should it be forgotten that genuinely sound economic schemes can only be built up on a sound ecological basis, even if this involves an apparent surrender of part of the cash reward. Plantations of trees in any countryside are a powerful contribution to such a sound basis; checking soil erosion and desiccation by strong, hot winds, from which parts of Sind suffer severely and also as an essential harbourage for birds, which in turn control insect pests. The Forest Department in Sind consequently has had to think ahead, not merely to maintain a good level of production under rapidly changing conditions on the estates under its direct management, but also to demonstrate that, for private land owners also, fuel production can be beneficial and profitable. Fortunately there are quite large Government areas interspersed among lands in private occupation outside the riverain zone. These had perhaps in many cases remained in Government hands because they were generally of poor quality and frequently surrounding some depression, which it was convenient to use as a general sump, or storage space, into which to drain off surplus irrigation water from the neighbouring lands under cultivation. Extensions of irrigation canals have gradually been bringing these poor forest lands under command. About seven years ago, therefore, the Forest Department started, in quite a small way, to try what was possible to develop them as irrigated plantations, in order to supplement the production of fuel on the riverain lands which was showing signs of not being adequate in the near future. Cultivation was an obvious tool to employ in forming such plantations. But gradually a technique is being developed, which seems to hold out promise and to merit much more extensive and scientific trials, so that the best combinations for alternating husbandry, of which there must be almost innumerable possibilities can gradually be worked out. The *babul* is a tree admirably suited for this purpose as it grows quickly, produces a hard timber good for fuel and is most excellent for charcoal manufacture. It has a light crown which does not throw down too dense a shade. Moreover it is leguminous and consequently a natural improver of the soil conditions. It further yields tanning essences from its bark, and finally gives excellent fodder from its seed pods as well as from the loppings of its young leaves. Other trees may also prove as useful for different reasons. At present the method usually adopted is to sow the tree seeds, in lines 33 ft. to 44 ft. apart, along with an arable crop, generally either cotton or *bajri*. Cultivation between the lines of young saplings can usually continue profitably for five to seven years, or in some cases even longer. Then as the shade from the trees gradually closes over the intervening strips of cultivation, these are turned down to grass for six to eight years until the tree crop is ripe for felling, when the whole process will be repeated. No finality of ideas as to the best procedure has yet been reached. Possibly another intervening crop of some sort of fruit between the tree lines, before putting down to fodder production, might prove successful. Details must depend on the amount of fertility which it is found by experience can be added to the soil and how this is best utilized during the alternating periods. There is an immense amount of scientific research work required before any definite claims can be made. What has actually been done can be seen from the accompanying photographs.

### *Success achieved*

From a rather hesitant start, some seven years ago on one small area under perennial irrigation, the Sind Forest Department has gradually extended the system from irrigated *kharif* crop areas to areas which are watered only by annual inundations from the Indus. Under these latter circumstances only *rabi* crops can be raised in winter, after the inundation water has receded, and it is much more difficult to get the tree seedlings to germinate and the young seedlings to become established properly in so short a season, to survive the following hot weather and be big enough to stand the next inundation. With care, attention and good fortune, this has proved possible. Consequently the Sind Forest Department has steadily extended the acreage on which the system is being worked, until in 1943-44 there were about 9,000 acres with perennial irrigation, 4,000 acres watered by inundation canals and about double this acreage with *rabi* crops under direct and uncontrolled inundation from the Indus. Much of the last class will have to be resown with tree seeds in lines for several years in succession before satisfactory germination, combined with a following inundation of suitable height and duration, can result in successful establishment. No finality in methods

has been attained and there is still a great deal to be learnt, particularly in the riverain areas.

### *Extended trials recommended*

In other parts of India where the monsoon rains are favourable there should be less difficulties to overcome and the special conditions of canal irrigation should, so far as can be seen, in no way be obligatory. It is just because the basic idea seems sound for Indian conditions and experience in Sind has been so encouraging, that this note has been written with the hope that research workers, as well as working landlords and large scale tenants, may feel interested to give extended trials. And perhaps administrators may be induced to encourage large schemes developing from a sound ecological basis to a properly balanced maximum productivity, in which the maintenance of soil fertility is recognized as being of vital importance.

## TREND OF ALTERNATE HUSBANDRY IN INDIA

IN much of India the need for growing human food to meet the demands of the dense population is so great that little or no attention can be devoted to the cultivation of grass leys or forage crops in rotation, even assuming that suitable herbage plants or forage crops are available. Ninety-five per cent of the animals in India attempt to obtain their fodder from natural grazings, with a small supplement of straw from arable crops. Natural conditions are unsuitable for grass production for more than half the year. The very dense animal population is also an important factor.

Agriculturists in many parts look with envious eyes on the controlled grazings in the forest reserves and consider that these should be made to provide grazing for the starving cattle, to supplement their normal quite insufficient fodder supplies. The pasturage in the forest reserves yields three times the amount of fodder produced in the grazing grounds outside the forests, and the fodder is of superior quality. If the grazing incidence in forest areas were to be increased, however, the carrying capacity would be adversely affected, and the balance between the conflicting types of land use, forestry and grazing, would be disturbed.

The problem is therefore whether the Indian Agriculturist can be persuaded that the introduction of some grass-legume mixture or a soil-improving forage crop is desirable and feasible, for the purpose of supplying a source of animal fodder which may be stored as hay or silage, for use in the dry season, and also for the purpose of improving the structure and therefore the fertility of the soil, both by root action and through the increased amount of animal manure which would be available. The production of more fodder from arable areas combined with other measures such as culling of useless stock might relieve the strain on the grazing grounds, which would thereby be given an oportunity to revive.

Ware (1941) has stressed the need for increasing the acreage under fodder crops in India. The area of cultivated land available per head of bovine population is given as 1·8 acres, as compared with 3·4 acres in Great Britain, 4·5 acres in New Zealand, 31·4 in Canada and 24·9 in U.S.A.

There is little information on the feasibility of introducing soil-improving crops into the rotation especially in non-irrigated regions. Where irrigation water is available, crops such as lucerne and berseem may be profitably grown. In other areas, the only crop which can claim to be a forage crop is *juar* (sorghum); this, however, is seldom grown merely as a forage crop, but rather both for grain and *kadbi* (the dry stalks). In any case, its root system is unlikely to be of a type which will have any very marked effect upon soil structure during the short period in which it occupies the ground.—*Alternate Husbandry*, Imperial Agricultural Bureaux, Joint Publication No. 6, May 1944.

# ROBBING IN *APIS INDICA* F

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ROBBING in honeybees is the habit of pilfering honey from other colonies. This habit is found in all the honeybees of the world but, as compared to other bees, *Apis indica* is more prone to robbing[1] both in nature as well as under domestication. Under natural conditions robbing may take place at any time, but in apiaries it usually is at its worst during late summer and the monsoon.

Causes which induce robbing are many and varied but the absence of a nectar flow from the flowers is an essential prerequisite for its commencement. During such periods of dearth, the bees are hard put to locate new sources of nectar supply and in their search for a suitable source, they visit sweetmeat shops, sugar and *gur* depots and canning plants. Such easy spoils act as *agents provocateur* : they look for more and more of them, discover weak[2] colonies, attack them and ransack their honey stores. Similarly faulty hives, spilling of sugar syrup, exposed honey etc. as well as indiscriminate feeding of weak colonies provoke the robbing urge. Too long or too frequent exposure of a particularly weak colony during examination also lays it open to the attack of the bees which have yielded to their robbing instinct.

## *Robbing*

In an apiary robbing may take place on any day during the dearth period. A band of bees goes out 'nosing' the chinks and crevices of other colonies and, on scenting honey in a colony, the members of the band try to enter it through openings other than the main entrance, which is guarded by the guard-bees. If entrance into the hive is effected through side chinks well and good ; otherwise the marauders make a frontal attack at the entrance which is keenly and determinedly resisted by the guards. Each one of the robbers is set upon by three or four guards. The marauder tries to dodge and repel the guards and when caught, it makes desperate efforts to fly out of their clutches. The guards catch the robber by its legs, cut off its wings, bite through its petiole (joint between the thorax and the abdomen) and try to sting it through its abdominal membranes. The combatants fly from the alighting board in front of the entrance to the ground, continue the fight till the intruder is seriously injured or killed, when its dead body is dragged unceremoniously away from the hive and left at some distance from it. If, however, the robber makes good its escape, it reattacks, to face the same resistance and treatment. If the attacked colony is strong enough to throw in an unending and ever increasing stream of defenders, a part of the band of robbers is quickly massacred while the survivors turn to their hive beaten and shamed, and the invasion turns out a flop. If the defending colony has no reserves, robbers overcome the guards, make a victorious entry into the hive which they loot mercilessly, plunge their heads into honey cells, fill themselves to capacity, return to their hive, disgorge the spoils and go back to the beaten colony, with a larger force to loot and ransack its honey stores.

The bees of the subdued colony resign themselves to their fate, stand by and see their hive mercilessly and completely robbed. Some beaten colonies, however, become so demoralized that they themselves carry their honey to the hive of the invaders.

Initial victories turn the heads, as it were, of the intruders. They attack other colonies in the apiary and rob them of their honey and kill their inmates. They carry on this abominable work unless they meet their match, which brings their undesirable career to an end.

## *Effects of robbing*

The general effects of robbing on the whole apiary are invariably devastating. Both the victors and the vanquished colonies suffer grievous losses in their population and the resultant commotion diverts the attention and interrupts the normal working of all the

[1] Rahman and Singh, Indian Farming, Vol. I. No. 1, 1940.

[2] Colonies with bees covering upto three Langstroth sized frames during a dearth period are generally adjudged as weak colonies. Their honey stores amount to 2 to 3 lb. and their brood area extends up to 100 sq. in. on both sides of the comb. On the other hand colonies with bees covering four or more such frames are called strong colonies. Their honey-stores amount to 10 to 15 lb. and their brood area extends to two to three frames and measures upto 500 sq. in.

colonies. As a result of robbing, colonies of bees (a) are killed, (b) lose their queens, (c) are reduced to a pitiable existence, and (d) fall an easy prey to their enemies. In our opinion failures of beginners in (a) modern bee-keeping, (b) maintaining their colonies strong, and (c) obtaining large surpluses of honey from them are, in the main, due to robbing which undoubtedly is the curse of beekeeping.

### *Prevention*

'Prevention is better than cure' is the golden rule which has to be followed in an apiary to safeguard against robbing. Hives should be bee-proof and should have only the customary entrance in front which should be reduced to ½ to 1 in. with the entrance block during the dearth period. Chinks in the hive should be closed with a mixture of clay and cowdung in equal parts. Tar-paper sheet under the wooden inner cover will also be found useful.

Artificial feeding of sugar syrup should be done late in the evening in dummy board feeders or in inverted tin feeders, which should be placed between the wall of the hive and the frames. No syrup should be spilt and if spilt should be carefully washed off and the entrances of the colonies to which syrup is given should be reduced to one bee-width. Weak colonies should not be given any syrup but they should be fed on sugarcandy or given frames full of honey from strong colonies instead. To reduce artificial feeding to the barest minimum or do away with it altogether, it is a good plan to leave about 15 lb. of honey in each hive at the time of extraction. Another precaution that pays is the manipulation of the colonies in the afternoon as quickly and as calmly as is consistent with efficiency.

The key to success against robbing is that the colonies in an apiary should be nearly of equal strength and to insure this weak colonies should always be united with the average colonies, by the Miller Newspaper Plan.[1]

### *Control*

If, in spite of the best efforts at preventing it, robbing gets started in an apiary, the beekeeper should at once shorten the entrances of all the colonies to one bee-width and place wet grass in front of, or rags soaked in crude carbolic acid, kerosene oil or phenyle near the entrance of the colony which is being robbed. A one-half to one per cent solution of carbolic acid in water sprinkled around the afflicted colony also helps in checking robbing. If in spite of all these measures robbing still persists, either the position of the colony which is being robbed should be exchanged with that of the robber colony[2] or the robbed colony (after properly closing the entrance with a piece of wire gauze screen) removed to a cold room (a cellar or *obrie*) and kept there for three days, or removed two miles away and an empty hive placed in its position to fool the robber bees.

[1] See *Beekeeping in the Punjab* by Rahman and Singh (1940) obtainable from Superintendent, Government Printing Punjab, Lahore.

[2] Sprinkling of wheat flour on the bees coming out of the colony which is being robbed and following them back to their hives helps in finding out the robber colonies.

## BEES AND WAR EFFORT

THE war has offered a golden opportunity to bee-keepers to organize themselves and to produce more honey and beeswax for the Defence Services and the civilian population to keep them in fine mettle and fine spirits. It is high time that bee-keepers offer their services to their brother zemindars, and fruit and vegetable growers for the production of larger crops in the present days of food shortage. The honey bee is constitutionally well organized for service and it is for us to take advantage of this little friend of ours.—K.A.R.

# CO-OPERATIVE MARKETING OF EGGS

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In India, poultry keeping is confined mainly to Muslims, Christians and some other castes. By far a major part of the business is done as a side industry and the number of poultry farms running on commercial lines is very small. The production of all types of eggs is estimated at 336½ crores per annum; of these about 90 per cent are from hen and the rest from ducks, the production from geese, turkey and guinea fowls being negligible. On an average 20 per cent of hens eggs are retained by producers for domestic consumption and another 20 per cent are used for hatching. About one per cent of the eggs are estimated to be mislaid, eaten by crows, etc. or remain uncollected. The balance is sold. In the case of ducks, however, on an average, 7·2 and 9·3 per cent of eggs are retained by producers for consumption and hatching respectively.

### *Village egg collectors*

The middlemen play a far more important part in the egg trade than in the trade of any other commodity, because the quantity and the value of eggs per individual producer are small and the producer is content with whatever he can get without taking the trouble of disposing off the produce. The first and the most important middleman is the village egg collector. He goes round five to eight villages in a day and brings his collection to the market. His margin of profit ranged between four and six annas per 100 eggs in pre-war normal times. Under the present abnormal conditions brought about by the war, it is estimated that the difference between the buying and selling prices of the village egg collectors varies between Rs. 1-8 and Rs. 3 per 100 eggs. Sometimes, merchants also employ egg collectors on monthly salary or commission basis.

There are about 150 important assembling centres in India, where more than 3,000 eggs are handled daily. There are usually no wholesale egg markets and the railway platforms are sometimes used for this purpose.

### *Transport and sale of eggs*

The majority of eggs put on the market are soiled with the droppings of hens and present a dirty appearance. This is more so in the case of duck eggs. Baskets are the chief containers used without any packing material. In the north, the breakage in transit varies from 10 to 30 per cent and the country loses about Rs. 15 lakhs annually due to damage caused by defective containers. For short distances, headloads, bicycles, *tongas*, *ekkas* and motor lorries are used for transport. Passenger, express, parcel or mail trains are the chief means of transport for sending consignments to far distant centres. Goods train is used only rarely. The cost of transport in normal times works out at 6 pies per dozen eggs, which comes to about 8 per cent of the retail price or 15 to 17 per cent of the producers' price. Storage and preservation of eggs is not practised on scientific lines, for which adequate facilities are not available in this country. On account of adverse weather conditions a considerable number of eggs get stale especially during summer months and the total loss on this account is estimated at about Rs. 25 lakhs per annum.

The basis of quoting prices varies from area to area and also at different stages during marketing. Dozen is the usual unit of sale in the retail business; but in Assam and Bengal the retail price is quoted per score. While buying eggs from producers, the collectors and wholesale merchants generally use 100 or 1,000 as unit. Generally speaking, flat rates are quoted without regard to the size and quality of eggs. The wholesale distributors only occasionally sort out the larger eggs and charge about one anna per dozen more than for others. Higher grades of Agmark eggs, however, are sold at a premium of 20 per cent over the ungraded eggs. Hen eggs are sold at higher prices in winter months and lowest in March though the peak is reached in July. Duck eggs fetch highest price from June to October and lowest in April. It has been estimated that the producer in general gets actually about 40 and 66 per cent of the price paid by the consumer for the hen eggs and duck eggs respectively.

### *Cooperative Societies*

To increase this portion of the sale money to the producer a large number of producers'

societies have been formed in different parts of the country in the past. Except a few, all of them have failed to achieve their object. The main cause of failure of this type of co-operatives has been the long distances separating producers and consumers, necessitating increase in the cost of collection. The other cause has been the difficulty of obtaining large numbers of eggs at any one producing centre. There are, as mentioned above, many centres in different provinces and states where a large number of eggs are daily assembled. A cooperative society for the marketing of eggs can advantageously be started at one or more of these centres.

### The Martandam Society

The Martandam Cooperative Poultry Society (Travancore), for instance, is functioning very successfully since 1928 and it is perhaps the only society which has an unblemished career of success for over 16 years. During the first eight years of its life, the Society only advanced loans to its members for the purchase of eggs, while the Youngmen's Christian Association Centre at Martandam made arrangements for the sale of the produce. Since 1936, the Society has also taken up the marketing of eggs of its members and limited its area of operation to seven miles from Martandam—a walking distance for rural population. A short description of this Society is given below :

*Capital and management :* Each member has to purchase at least one share of Rs. 5 payable in instalments within 20 months. The managing committee of the Society consisting of seven members, is elected by the general body for one year and looks after its day to day business.

*Assembling and grading of eggs :* Members of the Society bring their eggs on two fixed days in a week. Collections begin early in the morning and the members pass on their eggs to the grader employed by the Society for testing, grading and stamping the product. After this is done relevant entries are made in the pass book of the members and the registers of the Society. The Society makes outright purchases and pays the price to the members once a month on the basis of the entries made in the pass books and the registers of the Society. Every egg is tested by the simple method of water-test. The Society has got its own specifications and after the eggs have been graded they are rubber-stamped with the grade specification and the words 'Martandam Quality O.K.'. Eggs which do not conform to the quality are rejected and are disposed of by the producers themselves.

*Methods of packing eggs for despatch :* Eggs are wrapped separately according to their grade in coloured papers and are then placed in bamboo baskets in layers. Straw packing is provided at the bottom, on the sides and the top of the basket. A gunny cloth is sewn on the top and properly sealed before despatch.

*Sale of eggs :* It is interesting to note that the Society does not sell eggs through commission agents or to merchants. It has regular customers in Madras, Madura, Kodaikanal, Trichinopoly, Calicut, etc. who get their supplies of eggs once or twice a week. Eggs are supplied by the Society on the condition that if any egg is found bad within three days of receipt by the consumer, the Society replaces such bad eggs in the next consignment.

### Formation of marketing societies

Societies for the marketing of eggs on similar lines are most likely to succeed. An outline of a type scheme for egg producers' cooperative marketing societies is given here. It may perhaps be of interest to cooperators and they may like to adopt it in suitable areas, modifying the details according to local conditions.

The first essential is that cooperative marketing of eggs should be organized at centres where sufficiently large number of eggs are produced in a compact area and the society is able to get sufficient business to make it economically self-supporting.

*Objects of the society :* The society may have the following objects :

(a) To arrange for the collection of eggs from its members,

(b) To arrange for the grading and marketing of eggs so collected,

(c) To finance the members for the purchase of improved types of eggs and poultry in order to enable them to produce eggs of better quality,

(d) To inculcate amongst the members the habit of thrift, self-help and cooperation.

Other objects may be added according to local conditions and requirements.

*Area of operation :* The area of operation of the society should be limited to as many villages round a central place where a sufficiently large number of eggs can be collected to make the society financially sound. The area may be as compact as possible and the centre should be a place which is usually frequented by the

residents of the area. It is always better to have such a society farther from a city or town so that competition from other buyers may be comparatively less and eggs may be available at cheaper rates.

In case it is not possible to have the desired quantity of eggs from one centre, the society may have two or more places for collecting eggs. This, however, should be avoided as far as possible and separate societies may be formed in order to have effective supervision. These societies may together form a cooperative union. Such an union may serve all or any of the objects of the societies for their common benefit.

*Capital :* Capital of the society may be raised in the following ways :

(a) *Share capital*—Members may be required to purchase at least one share in the society. The value of the share will naturally depend on the paying capacity of the class to which the members belong. Since the members of such a society are likely to be poor, it is suggested that the value of a share may be small, say, Rs. 5, payable in small monthly instalments of annas 4 or annas 8 each.

(b) *Borrowings*—The society should be able to obtain loans from cooperative banks on easy terms for financing the marketing of eggs and advancing loans to members for the purchase and upkeep of poultry.

(c) Deposits from members and non-members.

(d) Donations from Government and other sources.

*Liability of members :* The liability of each member for the debts of the society should ordinarily be limited to the face value of the share or shares held by him.

*Management :* The supreme authority will be vested in the general body in which all the members will have not more than one vote each. The general body will elect a committee of 5, 7, 9 or 11 members, one of whom will be the President of the society, to act as the managing committee of the society. This committee will be empowered to handle the day to day business and will be responsible to the general body. The committee may appoint one of its members or employ a paid servant to act as Secretary of the society.

## Business procedure

(a) *Collection of eggs*—As has already been mentioned, the collection of eggs from producers by the employees of the cooperative societies on wages or on commission basis, has been, generally speaking, costly and has almost always been one of the main causes of failure of egg marketing societies. It is, therefore, desirable that arrangements for the collection of eggs should be made direct from members as is done by the Society at Martandam. Two, three or more days, according to convenience and the extent of business, may be fixed in a week for collecting eggs. On these days, members may bring their eggs to the society, where the Manager or the Secretary of the society may test and grade them. As soon as it is done, an entry to this effect may be made in the member's pass book, showing the number of eggs and their grades. Every egg should be tested for freshness. All the graded eggs may then be stamped with a rubber stamp bearing the grade. Eggs rejected for staleness should be returned to the producers. Incidentally, there should be no restriction on the supplies being made by non-members, but they should not be preferred or even treated on the same footing as members. Non-members may have an opportunity of having practical experience of the society's dealings and may thus be induced to join it. Provision should, however, be made in the by-laws prohibiting members to sell eggs produced by them to outsiders unless they are rejected by the society, failing which they may be required to pay a penalty.

(b) *Sale of eggs*—Before the collection of eggs takes place, it is desirable that the committee of the society should make arrangements direct with the consumers for the sale of the produce of members. This can be done in the local market if the supply is small or there is adequate demand for eggs on the spot ; but it is always better to have permanent buyers in important consuming centres. At these centres, it is wise to make permanent arrangements with well established cooperative stores, wholesale distributing societies such as the Provincial Co-operative Marketing Societies, Cooperative Stores, hotels, restaurants, etc. for the supply of eggs. In the ordinary course there should not be any difficulty in achieving this object. Stress should, however, always be laid on the *bona fides* of the other party, because a young society cannot afford to suffer losses.

(c) *Prices :* As has been mentioned above there is a seasonal rise and fall in the prices of eggs. It should, therefore. be generally possible for the society to fix the prices with its customers beforehand. The prices of eggs payable to producers should ordinarily be based on the consumer's price after taking into consideration the costs of management, handling, transportation

and the society's margin of profit. This price should not be less than what is paid by other collectors in the villages. The price of eggs should be paid to producers as soon as their eggs are graded and tested for freshness. The ideal, however, is to collect the eggs from the members, pool them according to grades and pay the price when the consignment is sold in a consuming centre. The society may in such a case deduct a small percentage as commission to cover the cost incurred and a small margin of profit. The experience, however, shows that this system is not very much appreciated by the class of people to which the egg producers generally belong. It may be emphasized that the society should not, as far as possible, attempt to act as a retail seller of eggs but should have direct dealings with approved customers and firms as has already been suggested. In retail sale, there is a lot of expense and risk involved and the return is not always commensurate with the labour involved.

(d) *Loans*—The society may require financial assistance for paying the prices of eggs to members, marketing eggs and advancing loans to its constituents to maintain birds and purchase improved types of fowls. The society can, if it is able to gain confidence of the local cooperative bank, get the necessary advance from it on reasonable terms. Advances to members may be made for the purposes mentioned above at a little higher rate of interest than is payable to the bank. Such loans should not, as far as possible, be paid in cash but fowls and poultry feed may be supplied by the society in lieu of cash payment. In case the advance has to be made in cash, the managing committee of the society should satisfy itself that the amount is used for the purpose it was taken. Outstanding loans may be realized from the price of eggs payable to the members in suitable instalments.

(e) *Profits*—No society should be started if it is not likely to earn a decent profit by middle or the end of the year as the case may be, unless necessary financial assistance is forthcoming from the Government or any other source and it is foreseen that by the time the aid is withdrawn the society will be able to stand on its own legs.

At the end of the year or half-year, when the profit and loss account of the society is prepared, profits may be distributed as under :

(1) To reserve fund—25 per cent.

(2) To dividend at 10 per cent on shares paid. After keeping suitable amount for improvement fund, the rest may be distributed amongst members as bonus on the basis of the value of eggs supplied by each during the period for which profits are declared.

# RICE IN ASSAM

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RICE (*Oryza sativa L.*) is by far the most important crop in Assam and is the staple food of the people of the province. Rice occupies about $5\frac{1}{2}$ million acres and claims quite 75 per cent of the total cultivated area in Assam and 7 per cent of the total area under rice in India.

The province of Assam falls under three natural divisions, viz. the Surma Valley, the Brahmaputra Valley and the hilly tract which separates the two Valleys. The Surma Valley is a flat plain with heavy clay to clayey loam soils with a rainfall of 100 to 200 in. and rice is cultivated all throughout. The Brahmaputra Valley is also an alluvial plain with three distinct tracts, viz. the new alluviums mostly inundated, the old alluviums ranging from sandy loam to heavy clay soils and lastly the sub-montane tracts including the vast savannahs consisting of gravelly and clay soils, of which a small area is under cultivation.

Owing to topographical differences, altitudes, monsoon, winds, rains and humidity, the province of Assam presents some unique features and rice is grown under a variety of conditions, ranging from comparatively dry, unirrigated conditions to wet, water-logged conditions, representing deep water tracts of more than 20 ft. and altitudes below sea level to 7,000 ft. The average mean annual rainfall is 140 and 80 in. in the Surma and Assam Valley respectively, the notoriously wet Cherrapunji in the Khasi Hills with an annual rainfall of 450 in. being on the northern boundary of the former. In fact, the warm moist climate of the two valleys makes them admirably suited to rice crop.

Rice in the province is chiefly grown as a rainfed crop. Most of the rice land of Assam is one-cropped and rice is grown year after year on the same land without any rotation on account of high rainfall during the period from May till October and lack of rain during the other months of the year. In the new alluvial tracts, specially in the inundated areas with loamy soil, double-cropping of rice is commonly practised, the early rice being grown first either broadcast or transplanted and the late rice (second crop) being almost invariably transplanted. A regular rotation is also practised in these early rice areas with crops such as jute, wheat, mustard, pulses etc.

## *Different varieties*

Various classes of rice are grown in Assam. These include a large number of varieties suited to different localities, depending mostly on the season and the water requirements of the plants. They may be briefly described under the following heads :

### *Broadcast aus or ahu (summer rice)*

This class of rice is grown on relatively higher lands. Its water requirement is comparatively less than those of the other classes of rice. Broadcast *aus* is generally sown in March-April and harvested in June-July. The seeds are sown at the rate of 60 to 80 lb. per acre. Land is prepared thoroughly and the soil well pulverized. After broadcasting seed, a light ploughing is given to cover the seeds. Weeding is regularly practised for the success of the broadcast *aus* rice. Harvesting is done when the grains in the lower part of the panicle are still somewhat green as this class of rice has a tendency to shed more easily when fully ripe. The area under this class of rice is about 6 lakhs of acres.

### *Transplanted aus or ahu (autumn rice)*

The transplanted *aus*, as its name implies, is first sown in the seed-bed in April and the early part of May, transplanted after 20 to 30 days and harvested in August. The seed-bed is prepared wet under puddled conditions and the sprouted seeds are sown at the rate of 5 to 6 maunds per acre. Generally cowdung at the rate of 150 maunds per acre is applied in the seed-bed. The land where the seedlings are planted finally is puddled well and kept flooded with water for thorough decomposition of grasses and weeds. The rice fields are levelled and enclosed by *ails* in order to hold the water that is required for the growth of the crop. At the time of transplantation, 1 to 2 in. of water in the field is retained. Three to four weeks old seedlings are then planted at about 6 in. apart putting three or four seedlings per

hole. The area under this class of rice is about 5 lakhs of acres.

*Sail or sali (transplanted winter rice)*

*Sail* or *sali* is by far the most important class of rice in Assam covering an area of about 30 lakhs of acres. It is generally grown on uninundated areas depending mostly on rain water. It can stand occasional floods which are not very high. The crop is invariably transplanted. It is sown in June-July, transplanted in July-August and harvested in November-December. The method of cultivation is practically the same as in the case of transplanted *aus*. Four to five weeks old seedlings are planted about 9 in. apart putting four or five seedlings per hole. When transplantation is done late, closer spacing and higher number of seedlings per hole are preferred. When the seedlings are established, 3 to 4 in. of water are retained in the field during the rest of the growing period until about 10 or 15 days before maturity of the crop. Generally the crop takes 30 to 35 days from the date of flowering to ripening. There are areas where two crops of rice are grown in the same land, viz. a crop of *sail* after *aus*. Immediately after the harvesting of *aus*, the land is prepared again for transplanting *sail*, advantage being taken of the early rains in Assam, specially in the Surma Valley.

*Aman (deep water winter rice)*

*Aman* is a deep water winter rice having a long and prostrate stem which remains floating in water. It is the main crop of the low lying areas, particularly in Sylhet district, which is subject to flood during the monsoon.

Deep water rice grows in six to twenty feet of water. It has the capacity to grow and keep pace with the rise of water. It is generally sown broadcast under both wet and dry conditions between March and the end of May and harvested by December-January. The best seed rate for dry sowing has been found to be about 80 to 100 lb. per acre, while for wet sowing a rate of 75 lb. per acre is sufficient to obtain a good yield. The area under this rice is about 12 lakh acres.

*Boro (spring rice)*

*Boro* rice is grown on the margins of *beels* and *haors* (shallow depressions), where water accumulates during the monsoon. Due to lack of natural drainage, the water level gradually recedes by evaporation and the land becomes fit for rice cultivation by November-December. Owing to the cup-shaped nature of the land, cultivation starts on the periphery and moves towards the centre. This rice is mainly grown in the Sylhet district and the area annually cropped is about 2 lakhs of acres. While *beels* supply most of the irrigation water for this crop, streams and rivers are also utilized in some areas. More recently due to the activity of the Agricultural Department, power-pumps have been used with great success in irrigating and growing *boro* crop on *aman* land as well as in the introduction of this crop in the Assam Valley, specially in the Goalpara and the Nowgong districts. *Boro* is sown in November, transplanted in December-January and harvested in April-May. With the recedence of flood water in November, the seed-bed is prepared on comparatively high-lying areas, where there are facilities for irrigating the young seedlings. The seed bed is manured with cowdung at the rate of 150 maunds per acre when the land happens to be poor.

In *beel* areas, weeds are cleared from the field when it is still under knee-deep water. The first ploughing is often done under water. Transplanting of *boro* is usually done in the latter part of December and continues up to the end of January. Experiments have shown that the period between the last week of December and the first week of January is the best time for transplanting *boro*. For early transplantation, four-weeks old seedlings are better, but for late planting five to six-weeks old seedlings are preferred. The best spacing is about 6 to 9 in., while not less than four seedlings should be put per clump as the death rate of seedlings in *boro* is higher than in any other class of rice.

### *Improvement of rice varieties*

Amongst the different classes of rice in Assam, hundreds of varieties are grown, which are generally mixtures of different forms. The varieties differ markedly in tillering, height, yielding capacity, in shape and size of grains, in thickness of *culms*, in length and branching habit of panicle, strength of straw, life period, and in lots of other morphological characters. The numerous varieties of local rice that have appeared and persisted through ages represent to a certain extent the survival of the fittest and some of these varieties are quite high-yielding and possess other desirable agronomic characters.

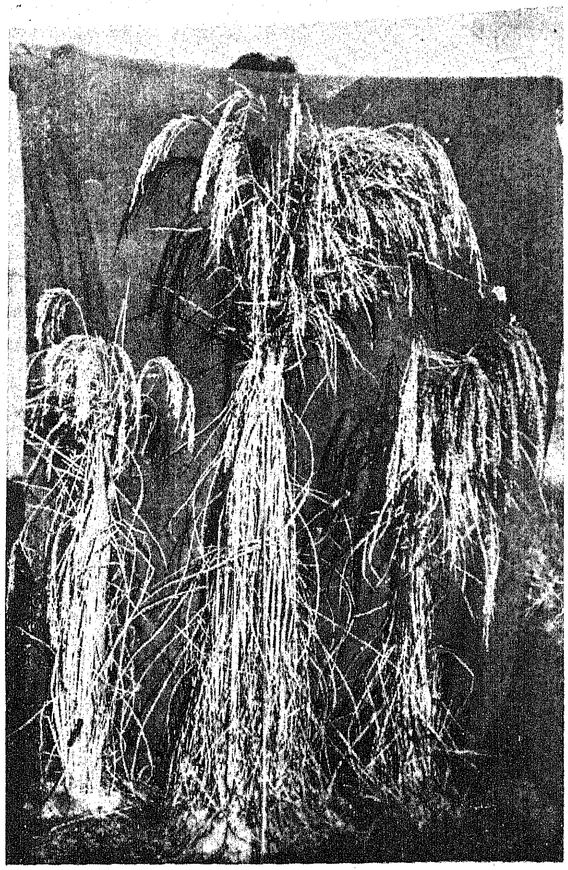

FIG. 1. Hybrid vigour of a $F_1$ cross


FIG. 2. $F_2$ culture of a cross raised from single seedling

The growing appreciation of the importance of plant breeding led to organized efforts in Assam for the improvement of rice, the staple food crop, by the three well-known methods of crop improvement, viz. (1) introduction of improved varieties, (2) pure-line selections from the local varieties and (3) creation of new varieties by breeding followed by selection. It is with this view that the Government of Assam established a Rice Research Station at Karimganj in the Surma Valley in 1914 and a similar one at Titabar in the Assam Valley in 1924, for the improvement of *aus* and *sail* rice crop, which covers three-fourths of the total rice area in Assam. In the year 1934, a third Rice Research Station was established at Habiganj in the Surma Valley, under a scheme financed by the Imperial Council of Agricultural Research, India, for the improvement of *aman* (deep water rice) and *boro* (spring rice). A large collection of rice varieties, both indigenous and exotic are maintained in these three stations. Up-to-date more than 4,000 pure-line types have been isolated from the varieties of rice under cultivation in Assam. Of the hundreds of types obtained from the different provinces of India, Burma, China, Siam, Malaya, Java, Japan, Spain, Italy and Russia, for the purpose of introduction, only a few Bengal types have been found to be well-adapted to the climatic conditions of this province and the rest did not do well to justify their introduction. Some of the foreign types were, however, found to possess valuable characters for breeding purposes and have been retained for hybridization work.

The improvement of commercial varieties of rice by plant or panicle selection is a comparatively simple but tedious process and several years' continuous work is necessary to reach the desired end in view. Accordingly this method of selection was resorted to in isolating the best types from the local and introduced varieties which consisted of mixtures of thousands of different forms. Considerable improvement in Assam rice crop was effected by pure-line selection work and 37 pure-line types of different classes of rice suited to the different localities have already been recommended to the cultivators for their high yield as well as other useful qualities. Pure seeds of these improved types which give on an average an increased yield of 10 to 15 per cent of grains over the local varieties are distributed every year to the cultivators from the different agricultural farms in the province.

When it was recognized that further improvement of rice varieties by pure-line selection was limited or exhausted, work on hybridization was undertaken for the production of new types possessing high yield and other ancilliary characters such as the quality of rice and resistance to diseases. The task of building up new types by breeding is not a simple matter and is a long and arduous process, which requires 7 to 10 years' continuous selection before a type can be recommended and released for general distribution. Recently a large number of crosses were done between different local and exotic types, the main object being to evolve high yielding strains with good milling quality and wide adaptability. Hundreds of promising hybrid strains with desirable agronomic and grain characters have been isolated from these crosses and are now undergoing yield trials. This method promises to yield very fruitful result and already six high yielding types produced by hybridization have been recommended to the cultivators. Two of these hybrid types viz. *Andrew sail* and *Kerr sail*, named respectively after His Excellency Sir Andrew Clow, the present Governor of Assam and His Excellency Sir John Kerr, ex-Governor of Assam, have been found to give 20 to 25 per cent increased yield of rice over the best local varieties in the cultivators' fields and have already become highly popular with the cultivators in almost all the districts of Assam. It is estimated that the area under these two improved types alone has gone upto 30,000 acres by 1943.

## Conclusion

Agricultural research work on rice which has already met with great success indicates that further improvement can be effected in Assam rice by breeding and selection. There is no reason why it should not be possible to evolve varieties that possess not only high yield but also other important characters that are required by the cultivators, millers and consumers. The difference between the average yield of best local rice varieties which is about 2,500 lb. of paddy per acre and the yield of improved rice varieties, such as *Kerr sail* or *Andrew sail*, which is about 3,500 lb. of paddy per acre indicate the enormous possibilities of increasing the average yield and production of rice in this province provided the economic advantages of these improvements are utilized with rapidity and on a scale which their value demands.

The latest census of India shows her population to be about 400 millions and the present war has brought to the forefront the necessity of augmenting the country's rice supply and the people have become more alive to the essential value of rice to the nation. Earnest and sustained efforts are, therefore, being made in Assam to increase her production of rice by large scale multiplication and distribution of seeds of improved rice varieties not only to meet the demand of a rapidly increasing population but also to have a surplus and thus help in some degree to replenish the all-India deficit which formerly was met by imports from Burma

## FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS

THE Interim Commission set up by the United Nations Conference on Food and Agriculture held at Hot Springs, Virginia, in 1943 has finished its work and submitted to the Governments concerned a constitution for a permanent international organization for food and agriculture under the name of the Food and Agricultural Organization of the United Nations. Alphabetically it will be known as FAO. As soon as 20 of the nations ratify the recommendations the new organization will get under way. It is hoped that this date may not be later than January 1945.

The broad objectives of the FAO as set forth in the preamble of the constitution are:

(i) To raise levels of nutrition and standards of living among people of the world.

(ii) To improve the efficiency of the production and distribution of all food and agricultural products.

(iii) To better the condition of rural populations.

(iv) To contribute by these means toward an expanding world economy.

The functions of the proposed organization are:

(1) To collect, analyze, interpret and disseminate information relating to nutrition, food and agriculture.

(2) To promote, and, where appropriate, recommend national and international action with respect to scientific, technological, social, and economic research relating to nutrition, food, and agricuture, and the spread of public knowledge of nutritional and agricultural science and practice.

(3) The conservation of natural resources and the adoption of improved methods of agricultural production.

(4) The improvement of processing, marketing and distribution of food and agricutural products.

(5) The adoption of policies for the provision of adequate agricultural credit, national and international and the adoption of international policies with respect to agricultural commodity arrangements.

The FAO is expceted to function principally as an advisory agency. Its constitution provides no powers to inaugurate programmes or to undertake definite actions. Its objectives are to be realized by promoting research, disseminating information and by making recommendations.—*Agricultural Mission Notes*, October, 1944.

# MEAT OFFALS FOR POULTRY

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THE poultry farmer rightly gives more attention to poultry feeding than to other aspects of production for, under average conditions, the cost of feeding the stock represents some 50 to 60 per cent of the total cost of running a poultry farm. Under commercial conditions the birds are usually unable to pick up any appreciable amount of food by foraging. It is therefore essential that the flock owner should feed well-balanced diets, for any omission of any of the essential foods will have serious effects on the general health and production of the flock. The farmer has also to study the prices of all food materials and to formulate a well balanced ration by a proper combination of these so as to get the best results at the lowest possible cost.

## *Low egg production*

In India the poultry industry is very backward and there is little reliable information in regard to commercial production. By far the greater part of the fowl population is kept in very small units under primitive conditions and, though accurate information about production is scanty, it can be safely assumed that the average egg production is very low. It is generally assumed that the primary limiting factor as regards egg production under village conditions is the poor quality of the *desi* fowls but this assumption is questionable. During the last three years, studies carried out by the author show that even pure-breed fowls give very low production records under ordinary village conditions. The limiting factors as regards production appear to be housing, feeding and management, the most important probably being lack of proper feeding.

## *Balanced feeding*

The quicker an animal grows the greater are its needs for body building foods such as proteins, minerals and vitamins. Compared with most other farm animals, fowls grow more quickly and it is, therefore necessary to supply them with feeds richer in all the essential body building constituents. High producing birds also require feeds rich in protein in order to maintain maximum egg production.

Birds, unlike most other farm stock, cannot digest bulky or coarse feeds and have, therefore, to be fed on grains which are low in fibre. Cereals and their by-products, on account of their palatability, digestibility and low cost per unit of energy, invariably form the basis of all poultry rations. However, cereals by themselves are badly balanced as regards the quantity and quality of their proteins and in poultry rations they have to be supplemented with other foods rich in protein.

## *Value of animal proteins*

Protein-rich food can be divided into two classes, namely, those of animal and vegetable origin. The animal proteins can be supplied to poultry as meat or meat meals, fish or fish meals and milk or milk products. It can be assumed that, as a general rule, animal protein supplements give better reults than vegetable protein supplements. The reason for the better results with the animal proteins is often not entirely understood. In most cases, animal proteins are better balanced as regards their amino-acid and vitamin contents. As animal proteins are usually more expensive than vegetable proteins, much of the recent research in various countries has been devoted to working out the minimum amounts of animal proteins that need be used in combination with cheaper vegetable proteins.

## *Use of separated milk*

Experiments carried out at the Imperial Veterinary Research Institute during the last five years have proved conclusively that excellent growth results can be obtained with cereal diets supplemented with separated milk *ad libitum* along with ample green food and calcium. During the first 8 weeks the best results were obtained with separated milk only to drink but from 8 weeks onwards it proved more economical to feed separated milk and water in separate containers. Good egg production records were obtained with the cereals plus separated milk and water in separate containers plus liberal amounts of green food and calcium. Where separated milk is not

available, equally good results can be obtained with butter-milk.

### Vegetable proteins and poor growth results

Recently on account of the greatly increased cost of all milk products and shortness of supply, other experiments were designed to test out the value of substitutes for milk both for growing chicks and laying fowls. Vegetable proteins such as soyabean meal and groundnut meal supplements have considerably poorer growth results than milk. In the diet of laying hens these vegetable proteins proved much inferior to milk.

### Experiments with meat offal

In another series of experiments, the separated milk was replaced with meat offal (intestines from goats, sheep and bullocks). The meat offal was selected for trial because of its availability and low price. Meat offal had previously been used in a small way in India by poultry keepers but no authentic information was available about its value in the ration of growing chickens or of laying birds.

To date, three different experiments with meat offal in the diet of chickens have been completed. In each of the experiments, the chickens were fed on a basal mash consisting of 50 parts wheat bran, 30 parts yellow maize meal and 20 parts ground oats. From 0-8 weeks the grain ration, which was fed morning and evening, consisted of equal parts broken yellow maize, *jowar* and *chena*. From 8 weeks onward the birds were fed a grain mixture of equal parts of broken yellow maize, wheat and paddy. Liberal amounts of succulent green food and broken limestone were fed throughout all stages of the experiments.

The meat offal was cooked for one hour in a small quantity of water and then run through a mincing machine prior to feeding. The cooked offal and the residual water were mixed with dry mash to give a crumbly mixture. From 0–12 weeks $\frac{3}{4}$ lb. of meat offal was added to every pound of dry mash. After 12 weeks $\frac{1}{2}$ lb. of meat offal was given along with every pound of dry mash. From 0–12 weeks the birds were fed wet mash at 8 a.m., 11 a.m., and 2 p.m. From 12 weeks the wet mash was fed at 10 a.m. and 3 p.m. Grain was fed according to appetite at 7 a.m. and 5 p.m.

### Good growth with meat offal

In all the experiments, the addition of meat offal to the cereal diet greatly improved the rate of growth and the general health of the birds. The addition of meat offal accelerated sexual maturity and increased the efficiency of food utilization. The meat offal supplement gave consistently better results than vegetable protein supplements and as good results as separated milk.

### Experiments with laying birds

Three separate experiments with groups of 50 laying pullets were carried out to investigate the value of meat offal in the ration of laying birds. The birds in the various groups were fed the usual basal mash of 50 parts wheat bran, 30 parts yellow maize meal and 20 parts ground oats. The grain ration to all groups consisted of a mixture of equal parts of crushed yellow maize, wheat and paddy. Liberal amounts of broken limestone and green food were also fed.

The meat offal was fed at the rate of approximately 1 oz. per bird per day. After weighing, the meat offal was cooked for one hour, minced and mixed up with the mash. The birds were fed wet mash, consisting of 1 oz. of meat offal and 1·2 oz. of dry mash per bird at 7 a.m., 2 oz. of grain per bird at 11 a.m. and as much grain as they would consume in the evening. Dry mash was also fed in waste proof hoppers from 10 a.m. to 5 p.m.

### Results achieved

The groups receiving the meat offal laid approximately 25 per cent more eggs than those receiving no protein supplement or vegetable protein supplements. The addition of meat offal also increased egg size and the efficiency of food utilization as judged by the food consumed per pound of egg produced.

The meat offal ration gave on the average, slightly lower egg production records than a ration containing separated milk. The separated milk ration also gave somewhat better hatchability in two different experiments but in the third experiment the hatchability results were similar for both protein supplements.

### Economics of feeding

The type of protein supplement which should be used both for chickens or for laying birds largely depends on local conditions and prices. If cheap supplies of separated milk or buttermilk are available, the poultry farmer could do no better than to supplement his rations with these. With young chickens, separated

milk or buttermilk should be fed *ad libitum* instead of water up to eight weeks. After eight weeks up to maturity and at all later stages good results will be obtaind by feeding separated milk or buttermilk and water in separate containers. If milk products are expensive, meat offal makes an excellent substitute both for chicks and laying hens. With young chickens the meat offal should be fed at a level which will raise the protein content of the combined mash and grain consumed to at least 15 per cent. From eight weeks up to maturity the protein level of the combined mash and grain can be lowered to about 12·5 per cent. During laying good results will be obtained with a total protein content of about 14 per cent. Where both milk and meat offal are expensive fair results can be obtained with vegetable protein rich supplements such as groundnut meal or soya-bean meal supplemented with salt.

The practical producer naturally wants to know when he should substitute meat offal for milk or *vice versa*. Provided unadulterated separated milk or butter milk are available one pound of meat offal is equivalent in feeding value to about four pounds of milk. If the milk is adulterated with water, as it usually is, one pound of meat offal is equivalent to more than four pounds of milk.

## HEALTH OF POULTRY AN IMPORTANT ASSET

A high degree of health is the greatest asset of the poultry flock. By nature birds are healthy. When they are not, there is a definite cause. The alert poultrymen can foresee trouble coming, and in most cases can take steps to prevent it. Some of the signs of departure from the normal or early cessation of production are sharpness of the keel bone when felt by hand, thinness of the abdomen, dryness of the skin, and dullness of the eye. They justify an immediate search for the cause. The very actions of the flock, the way that they greet the feeder, their industry, the uniformity of their daily feed consumption and many other things are all indications of health to be.

Trapnesting which entails the handling of the birds every day helps the poultryman to know his flock intimately. The moment a bird slips into his hands, a keen poultryman knows whether that hen is going to continue laying or not. In addition to the head points, the hen feels warm and firm, plump and well-conditioned, with a reserve of soft fat apparent in the abdomen, and with the skin soft and velvety to the touch. Time spent with the birds is time well spent, and enables the poultryman to feel great satisfaction in fulfilling to the letter what he knows to be his first responsibility—the health of his flock.—*Canadion Note.*

# LEAF-FALL AND FRUIT-ROT DISEASE OF ORANGES

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and
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A leaf-fall and fruit-rot disease of oranges due to *Phytophthora palmivora* is prevalent in all the orange growing tracts of Coorg. Out of a total acreage moderately estimated at 10,000 acres, the disease is present in half the area and an annual loss of two lakhs of rupees to the planters would not be an exaggeration. The disease attacks trees growing in all kinds of soils and at all altitudes upto to a height of 4,000 ft. above the sea level, young seedlings in the nursery, non-bearing young trees and bearing trees as old as a hundred years, being attacked. The rain-fall varies in Coorg from about 40 in. up to 200 in. per annum and oranges are grown all over these tracts; the disease is present almost everywhere.

The leaf-fall first manifests itself at the end of May or early in June with the onset of the monsoon. The suddenness of the attack and the rapidity with which the disease spreads form the most characteristic features. The earliest symptom is the shedding of the leaves on the lower branches of the affected trees in enormous numbers. Gradually this spreads upwards. The affected leaves have dark brownish patches, which are slightly watery in appearance. Later when the fruits are formed, they are also attacked by the fungus. The fruits develop water-soaked, dark-brown patches, begin to rot and eventually drop off. Both the affected leaves and the fruits emit a foul odour which appears to be characteristic of this disease. If in an orchard there are two or three affected trees, the odour which their affected parts emit, spreads all over the area. Fully affected trees get shorn of all their leaves and at their bases large quantities of rotten fruits and leaves accumulate. The trees are not, however, entirely killed but there is little doubt that they are much weakened by the attack and their life is shortened. With the advent of the dry weather new growth is put forth by the plants which may again be attacked the following monsoon.

The disease has been reported from Wyanad in the Malabar District, Madras Province and the Department of Agriculture has developed satisfactory methods of controlling it. It has been found that timely sprays with one per cent Bordeaux mixture effectively controls the disease. This control measure was also adopted in Coorg and trials were conducted in different parts of the province. These have given very satisfactory results and the following conclusions have been drawn:

(1) Fallen leaves and fruits of the previous year must be first collected and burnt.

(2) A single spray in late May with one per cent Bordeaux mixture is sufficient to prevent the onset of the disease.

(3) The mistifier should be used for spraying rather than the jet and care should be taken to see that the spray fluid reaches all parts of the tree.

(4) Spraying badly affected trees during the height of the monsoon is not of any immediate use, though it may help the plant to flush out luxuriantly after the monsoon.

(5) Weaker strengths of Bordeaux mixtures have proved a complete failure.

(6) If the fungus appears later in the season, say in August or September, a second spray with the same strength of Bordeaux must be given, as soon as the symptoms are noticed.

In the table below are recorded the results of a few trials laid out in the planters' groves at different places in the province. The differences in spraying costs given in the table are, it may be noted, due to differences in labour costs. The cost of the fruit, given in the table is calculated at Rs. 30 per 1,000 fruits.

| Trial No. | Yield of 100 trees sprayed | unsprayed | Cost of extra fruits from sprayed trees | Cost of spraying | Net gain per acre (100 trees) |
|---|---|---|---|---|---|
| | | | Rs. | Rs. | Rs. |
| 1. | 15,718 | 9,578 | 184–3–0 | 15–14–0 | 168–5–0 |
| 2. | 30,000 | 22,500 | 225–0–0 | 16–10–0 | 208–6–0 |
| 3. | 2,250 | 750 | 45–0–0 | 15–0–0 | 30–0–0 |
| 4. | 8,200 | 3,300 | 147–0–0 | 8–6–0 | 138–10–0 |

The trees in the first three trials received two sprays, as the disease reappeared in September. It may be added that several planters were encouraged to spray their trees also with very satisfactory results.

When copper sulphate was selling at Rs. 52 per cwt. the spraying cost per acre worked out at about Rs. 10. The cost of copper sulphate, however, has risen considerably but that is compensated by the rise in the cost of fruits also, so that it is economical to resort to spraying systematically to prevent loss by leaf-fall and fruit-rot.

The writers desire to express their gratitude to Mr K.M. Thomas, Government Mycologist, Department of Agriculture, Madras Province, for the valuable advice he gave in laying down the above spray trials.

It must also be stated that research work on this disease was made possible due to the financial aid given by the Imperial Council of Agricultural Research for the Coorg Orange Research Scheme.

## D. D. T.

DICHLOR-DIPHENYL-TRICHLORETHANE (D.D.T.) was originally synthesized by Othamar Zeidler in 1874 and its physiological and pharmacological properties remained unknown till this important chemical was rediscovered by Paul Muller of the U.S.A. Department of Agriculture. But Frey of Cincinnati Chemical Works, U.S.A., solved the problem of its production on a commercial scale. The Americans consider it one of the most important discoveries of World War II and truly this insecticide can be termed as such. Paul Muller found that it killed bugs and it was first tested in 1939 during the plague of potatoes where it killed all the beetles. In 1943 it was used in Naples where it stopped the epidemic of Typhus. The matter must have been of very considerable importance that the Prime Minister Churchill made a special mention of D.D.T. in his latest review of war before the House of Commons. D.D.T. promises to wipe out mosquito and malaria and to destory household pests such as cockroaches and bedbugs, and to control some of the most damaging insects. Lt.-Col. Ahnfeldt, of U.S. Surgeon-General's Office, considers that D.D.T. will be to preventive medicine what Listers' discovery of antiseptics was to surgery.

The use of D.D.T. as delousing agent against Typhus has been an open secret in America for several months. But in June last for the first time its manufacturers and Army, Agriculture and W.P.B. Officials announced some of its amazing properties : (1) If sprayed on a wall it kills any fly that touches the wall for as long as three months afterwards; (2) a bed sprayed with D.D.T. remains deadly to bedbugs for 300 days ; (3) clothing dusted with it is safe from lice for a month, even after eight laundrings ; (4) a few ounces dropped in a swamp kills all mosquito larvae ; (5) it is deadly to household pests such as moths, cockroaches, termites and dog's fleas ; (6) as a crop protector, it is deadlier and longer lasting than other insecticides. It has been found effective against potato beetles, cabbage worms, Japanese beetles, fruit worms against which other insecticides have proved to be failures.

U.S.A. has a very big progamme in hand for its production but all for the army. D.D.T. owes its deadliness both as a contact and a stomach poison. It first paralyzes hind legs of an insect and finally brings complete paralysis and death. It is remarkable that pure chemical has little effect. It is used in an oil solution or mixed with an inert powder. The usual dose is 1–5 per cent. D.D.T. It is nontoxic to human beings in the concentration which is used.

For the first time it was synthesized in the Government Industrial Laboratory at Hyderabad (Deccan), and a programme for producing it on a larger scale has been undertaken.—*Current Science*, November 1944.

# DISTRIBUTION OF WHITE-FLY IN THE PUNJAB

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WITH a view to study the distribution and relative incidence of *B. gossypiperda* (white-fly) under different climatic conditions, an extensive survey was carried out in the Punjab during 1934 and 1935. All the district towns were visited and observations were made from July to September each year. In order to have a general impression about the infestation, cotton fields at the Government experimental farms at each station and some belonging to the neighbouring cultivators were examined. Representative samples of top, middle and bottom leaves were taken from all the fields and immature stages of white-fly were counted on them. The incidence of attack was worked out in relation to the leaf area examined. In places such as Kangra, Palampur, Solan and Simla which form the hilly tracts and where cotton crop was not available, observations were made on some of the alternative food-plants both cultivated and wild. The information was further supplemented by the data regarding the varieties under cultivation, soil variations, crop rotation, nature of irrigation, temperature, humidity, rainfall etc.

Practically all the district towns and some other important localities were visited during the two years and observations were made to study the relative infestation of this pest in relation to climatic and other factors. The data collected in this respect have shown that the entire province may be divided into the following four zones: (1) Kangra, Palampur, Kalka and Solan where the pest has been simply recorded on some vegetables.

(2) Ferozepur, Hansi, Gurgaon, Rohtak, Karnal, Ambala, Ludhiana, Jullundur and Hoshiarpur where the entire cultivation was of *desi* cottons except small representation of American types at the Government Farms. Soil was clay loam or sandy loam and irrigation by canals, *chahi* or *barani*. The infestation was extremely low, ranging between 0·15 to 1·0 with an average of 0·43 per sq. inch.



(3) Gurdaspur, Amritsar, Gujranwala, Sialkot, Gujarat, Jhelum, Rawalpindi, Campbellpur, Mianwali and D.G. Khan, where both *desi* and American cottons were grown at most of the localities. Soil was variable being loamy, *bara*, *kalrathi*, sandy, etc. Irrigation was mostly *chahi* excepting Gujranwala and Rawalpindi where the cultivation was *barani*. The infestation ranged between 0·16 to 1·74 with an average of 0·76 per sq. inch.

(4) Sheikhupura, Lahore, Montgomery, Multan, Muzaffargarh, Jhang, Sargodha and Lyallpur, where both *desi* and American varieties of cotton were grown. Mostly the crops were canal-irrigated but *chahi* only at Multan; soil was mostly loamy. Infestation ranged between 0·41 to 5·61 with an average of 2·13 per sq. inch.

These investigations have shown that, besides the agricultural practices, soil and irrigation climate is the most significant factor in controlling the distribution and spread of this pest. Well distributed showers of rain during the active period of the pest form a considerable natural check on its multiplication since the adults are killed and their multiplication is decreased. The pest, as a rule, multiplies rapidly under high temperature and relatively low humidity.

The above statement is supported by the data presented in table I, showing the relative intensity of white-fly attack in relation to temperature, humidity and rain-fall. Moreover, it has been observed that the crop which receives less irrigation is more susceptible to white-fly attack than the one receiving frequent irrigation.

In nature, therefore, the attack is the highest in the central canal colony where the temperature is relatively high and the rainfall scanty which obviously lowers the humidity. On the other hand, the attack is the lowest in the south-east and north-west Punjab, where rainfall and humidity are comparatively high and the climate is rather temperate.

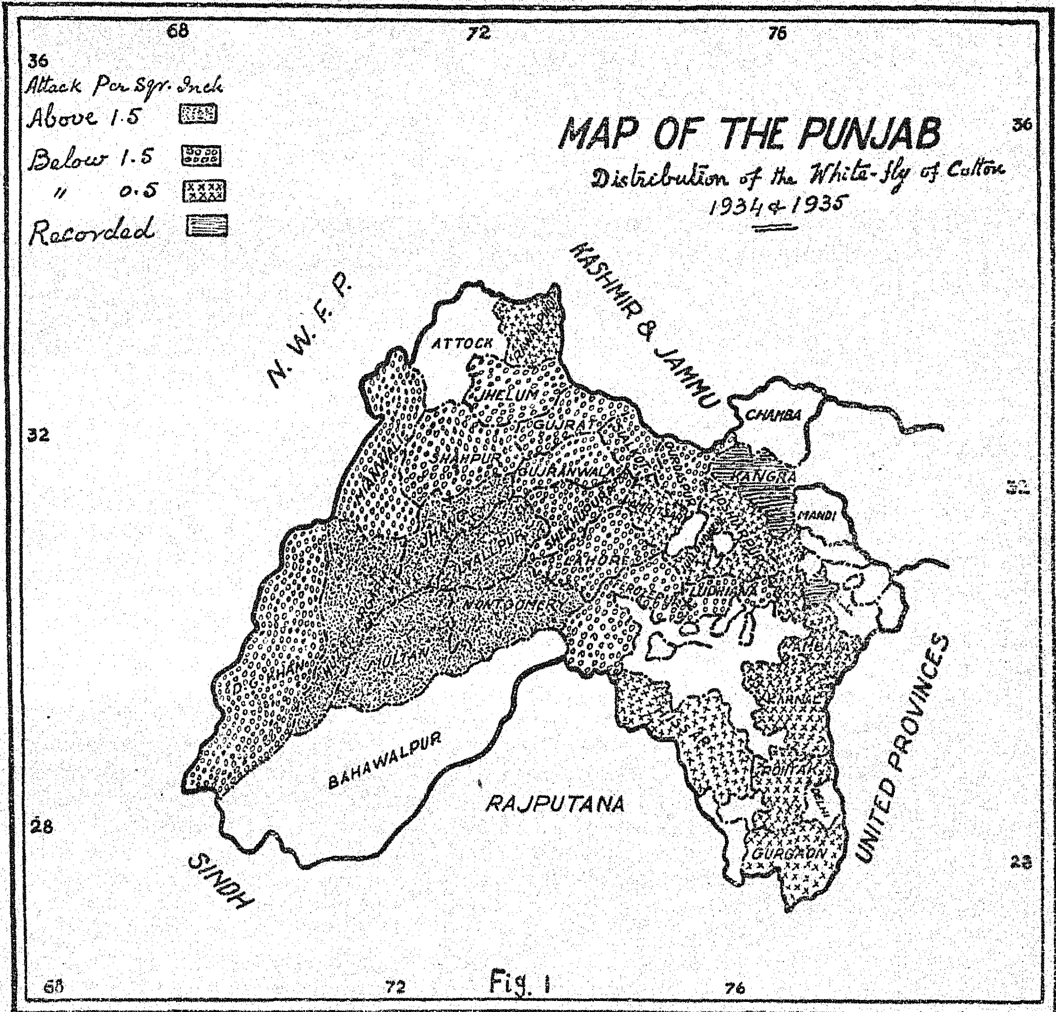

Fig. 1

It may be added at the same time, that altitude also plays a considerable part in the distribution of this insect. Although the pest has been found present on some of the alternative food-plants, at Solan and Palampur at a height of about 4,900 ft., it was simply recorded and the infestation was quite insignificant. At Simla, however, at a height of about 7,000 ft. this species has not been recorded at all.

*Table I.*

Climatic factors and the incidence of *B. gossypiperda* at various localities in the Punjab during 1934 and 1935.

| Localities | Average – May to September: Infestation per sq. inch | Maximum temperature F°. | Minimum temperature F°. | Humidity | Total rainfall | Remarks. |
|---|---|---|---|---|---|---|
| Rohtak, Ambala, Rawalpindi | Below 0·5 | 98·3 | 76·4 | 58 | 23·39 | Maximum attack coincides with the maximum temperature, lowest relative humidity and the least rainfall. |
| Hansi | | | | | | |
| Ludhiana, Sialkot, Lahore | Below 1·0 | 100·0 | 76·8 | 59 | 18·06 | |
| Gurdaspur, Multan, Shahpur, Sargodha | Below 2·0 | 101·4 | 78·5 | 56 | 10·70 | |
| Montgomery, Lyallpur | Above 2·0 | 101·9 | 78·5 | 54 | 6·06 | |

# DOES ACCLIMATIZED CIGARETTE TOBACCO SEED DETERIORATE ?

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ONE of the problems on which the Tobacco Research Substation, Guntur, has been engaged is that of the deterioration in the quality of the cigarette tobacco crop which was believed to occur following the use of acclimatized seed.

In the early days, when cigarette tobacco cultivation was introduced into India seed of the Virginian varieties of tobacco had to be obtained from the U.S.A. as none of the Indian varieties was found to produce a leaf suitable for cigarette manufacture. Thereafter the leading tobacco organizations continued to obtain their supply of seed from abroad. The impression was created that to produce good quality crops seed should be procured from its original home every other year and that, after one or two years of acclimatization, the crop deteriorates in quality. Though this belief was apparently without any scientific foundation it gained considerable currency here, and in the U.S.A. it became the basis of prohibitory legislation placing an embargo on the export of tobacco seed from America.

So widespread was this belief that the Tobacco Research Substation undertook to test it by actual experimentation and the work was started in 1938-39. Fresh seed was obtained directly from America[1]. Seed was also taken from a crop that had been grown in India for only one year, while seed derived from a stock originally imported from America in 1933-34 and grown in Pusa since then was used as the control. The experiment was conducted for three years. Leaf samples were sent to trade experts for opinion. The crops though raised from seed in different stages of acclimatization did not show any material differences in growth, yield or the quality of the cured product. The small variations in growth or yield were however generally in favour of acclimatized seed.

Valuation of the cured leaf by trade experts gave the following results:

*Valuation in annas per lb.*

| Stage in acclimatization | Grades 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Directly imported | 4·8 | 4·08 | 3·2 | 2·64 |
| Acclimatized for one year .. | 3·2* | 4·00 | 3·28 | 2·08 |
| Acclimatized for several years .. | 4·0* | 4·16 | 3·12 | 2·56 |

*One year's valuation only

The calculated returns per acre were as follows:

| | Rs. | as. | p. |
|---|---|---|---|
| Directly imported | 108 | 8 | 8 |
| Acclimatized for one year | 105 | 3 | 2 |
| Acclimatized for several years | 107 | 9 | 3 |

The valuations and the returns per acre, it will be seen, differ only very slightly.

The following table gives the yield and grading analysis of cured leaf :

Yield and Grading Analysis
(*Average of three years, 1938-39 to 1940-41*).

| | Acre yield lb. | Percentage of bright leaf | Percentage of semi-bright leaf | Percentage of Dark leaf |
|---|---|---|---|---|
| Directly imported seed .. .. | 635·83 | 44·74 | 29·47 | 25·79 |
| Acclimatized for one year .. .. | 689·31 | 48·54 | 23·45 | 28·00 |
| Acclimatized for several years .. | 686·00 | 47·35 | 24·42 | 28·23 |

Side by side with this main experiment, a small observation plot was raised from seed imported from Canada and this crop was similar to the other crops in all respects.

[1] Our thanks are due to Dr W. W. Garner of the U.S. Department of Agriculture, and the I. L. T. D. Co. Ltd., Chirala, for the supply of 'directly imported seed', and to the Indian Tobacco Association, for valuation of the cured leaf.

An attempt was made to find a possible reason for the prevailing notions about the deterioration of Virginian tobacco varieties. Till very recently, the Indian Leaf Tobacco Development Co. Ltd. was the only source of supply of pure seedlings and seed. While the seedlings supplied by this organization were for the most part pure and produced good crops, seedlings from other sources were of very doubtful purity. Seed used by the cultivators, because of carelessness in harvesting and storing, often got mixed up with the seed of indigenous varieties. The result was that many fields contained a varying proportion (sometimes even half and half) of hybrid and off-type plants which did not and could not cure to the yellow colour desired in a cigarette tobacco. The consequence was that the quality of leaf, judged as a whole, went down and the proportions of good leaf decreased, creating the impression that quality tends to go down with acclimatization.

But the Guntur experiments have shown clearly that we need no longer depend on outside sources of supply of seed and that we can rely on pure seed grown in India to give us the best quality of leaf that can be produced under our conditions of soil and climate. The quality of crops can be easily improved by using pure seed and the agricultural departments can assist the farmers by providing them with enough pure seed to meet their needs both for the original sowing and the subsequent re-sowing which is often necessary, so that the *ryot* may not be tempted or forced to use seed of doubtful purity.

## INDIAN TOBACCO INDUSTRY

A comprehensive scheme for the improvement and development of tobacco production has been sanctioned by Government. The Indian Central Tobacco Committee, which will be set up very shortly, is to be responsible for research into, and the development and marketing of, Indian grown tobacco. The scheme will cost about Rs. 1.6 million. Government has already given Rs. 1 million annually from the Tobacco Excise Fund towards the expenses of this Committee.—*Indian News and Notes.*

# BALUCHISTAN SULPHUR FOR PLANT DISEASES

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SULPHUR is the basis of a number of important fungicides and insecticides. Before the war, it was imported into India, but it can now only be obtained on a high priority. The Imperial Mycologist has had under investigation for several years the possibility of using the natural deposits of sulphur in Baluchistan.

For plant pest and disease control purposes, sulphur is used in several forms :

## Forms and uses of sulphur

1. *As a fine dust :*

(a) For the control of certain seed-borne fungous diseases (certain smuts).

(b) For the control of 'powdery mildews' (i.e. diseases caused by fungi of the family *Erysiphaceae.*)

2. *As a polysulphide (lime-sulphur) spray :*

(a) For controlling powdery mildews and some other diseases of a rather superficial nature.

(b) For controlling various insect pests.

3. *As a colloidal sulphur spray :*

(a) For the same purposes as (2) (a).

4. *As sulphur dioxide fumigant :*

(a) For powdery mildews in glasshouses.

(b) For fumigating foodstuffs, grains, etc. against insects.

## Uses in India : specifications

For control of fungous plant diseases in India (as distinct from insect pests) sulphur is used fairly extensively as follows :

(1) For control of grain smut (*Sphacelotheca sorghi*) of *jowar* (*Sorghum vulgare*). This disease is common throughout India wherever *jowar* is grown. It completely destroys the grains and takes a heavy toll of yield which is conservatively estimated at 5 per cent. Spores from infected grains become mixed with healthy grains, germinate along with them, continue in the growing point of the plant, and appear again in the ears.

Dressing the seed with sulphur capable of passing a 200 mesh sieve, at the dosage 1 part sulphur to 250 parts seed, is commonly recommended. It is a cheap and effective control measure.



(2) For control of covered smut (*Ustilago hordei*) of barley. The life-history of the fungus causing this disease resembles that of the *jowar* smut fungus, and in Egypt sulphur treatment of a similar nature is widely recommended. Preliminary experiments indicate that the treatment may be equally effective in India.

(3) For control of powdery mildews, e.g. powdery mildew of grapevines, mango, betel-vines, cumin, etc. For this purpose, also, sulphur fine enough to pass through a 200 mesh sieve is usually recommended.

(4) For control of powdery mildews of fruit trees, e.g. apples, pears, peaches, etc. where there are also insects to be controlled. For this purpose lime-sulphur solutions are prepared by boiling 50 lb. of quicklime and 100 lb. of sulphur in 50 gallons of water. Such a solution should give a Baumé reading of at least 28° and is diluted to about 0·5° to 2° Baumé for spraying.

## Nature of Baluchistan sulphur

The Baluchistan sulphur deposits contain from 30 to 80 per cent sulphur and the remainder various impurities, including a large proportion of silica and other inert substances. The cost of purification may be rather too high to enable the deposits to be developed in normal times on this basis. A limited amount of flowers of sulphur is available at Koh-i-Sultan at a price of approximately Rs. 30 per cwt. f.o.r. Nok-Kundi.

## Use of the crude sulphur

Experiments carried out at the Imperial Agricultural Research Institute on the control of covered smut of barley and grain smut of *jowar* as well as similar results have already been reported by G. S. Kulkarni, Government Mycologist, Gwalior, in the *Current Science* February, 1944. The sulphur used at the Imperial Agricultural Research Institute was 75 per cent pure, that used in Gwalior only 56 per cent pure. In both cases complete control of *jowar* smut resulted.

The experiment with barley smut cannot be

considered to have been done on a sufficiently large scale to be regarded as conclusive. In any case sulphur of a comparatively high degree of purity was used.

As regards *jowar* smut, there is no doubt that sulphur, even of 56 per cent purity, ground to pass 100 mesh, gives good control of the disease.

The Officer-in-Charge, Sulphur Operations, Koh-i-Sultan, has recently supplied to the Imperial Mycologist a sample of 60 per cent sulphur said to be of 100 mesh fineness. Lime sulphur solution was prepared from this substance according to the standard formula. The yield was poor, (barely half normal) owing to much water being absorbed in the residual gel-like mass. The Baumé reading was only 24°. The practical difficulties of filtration on a large scale would be considerable.

The use of Baluchistan sulphur dust for controlling powdery mildews and similar diseases has not been tested.

## Conclusions

Crude Baluchistan sulphur powder of 60 per cent purity is unsuitable for preparation of lime-sulphur solution. It requires thorough testing before it can be recommended for controlling covered smut of barley and powdery mildews and similar diseases of other plants.

During the shortage of supplies of higher grades of sulphur, Baluchistan sulphur guaranteed to contain 60 per cent sulphur and to pass a 100 mesh sieve can be recommended for use for the purpose of controlling grain smut of *jowar*.

It is understood that 100-mesh sulphur could be put on the market at a price of about Rs. 10 per cwt., f.o.r. Nok-kundi. It is essential that it should pass a 100-mesh sieve.

The acreage of *jowar* in India is approximately 38,649,000 and the total yield 6,564,000 tons. At a conservative estimate of a 5 per cent level of infection with grain smut the total loss in yield due to this disease is 328,000 tons. About 500 tons of sulphur would be required annually to treat all the *jowar* sown. The total cost of this sulphur at Rs. 10 per cwt. would be Rs. 100,000 plus rail charges. Thus at a small cost it is possible to ensure an increase of over 300,000 tons of foodstuff per annum.

# CULTIVATION OF MUSHROOMS IN BURMA

L. N. Seth

*Mycologist, Burma*[1]

MUSHROOMS as an article of diet are held in high esteem in Burma. Various edible species appear naturally on partially decayed paddy straw, on grass lands, on manure heaps, on termites nests and in forests during the rainy season from June to September. The most popular ones are *Kauk-yo-Hmo* (*Volvaria diplasia* B and Br.) *Taung-bo-Hmo* [*Collybia albuminosa* (Berk.) Petch] and *Hmo-on-net* (*Entoloma microcarpum* Berk and Br.). The first one grows on paddy straw and the other two on termites nests. The paddy straw mushroom which has been successfully cultivated by Su and Seth (1940) can only be grown from March to October in the plains when the minimum temperature does not fall below 70°F. Thus, it is not possible to grow this mushroom in the plains during the winter season nor on the hills during the summer season. It was with a view to finding a method of cultivation of a suitable mushroom, when the paddy straw mushroom cannot be grown, that the present study was undertaken.

## The common mushroom

Padwick (1941) has described at length the method of cultivation of the so-called 'Common mushroom' or 'Edible mushroom' [*Psalliota campestris* (L.) Fr.]. According to him the cultivation of this mushroom has been tried, often without success, in India and its growing is a complicated process with many difficulties attending it. Padwick mentions that some success seems to have been achieved in the cultivation of *Volvaria diplasia*, *Panoeolus cyanescens* B and Br. and *Coprinus niveus* Fr. *P. cyanescens* is found commonly growing on cowdung heaps in Burma and is known locally as *Nauk-chee-Hmo*. It definitely belongs to the class of poisonous mushrooms and Padwick has not assigned any reason for its cultivation in India. According to Bose and Bose (1940), in their account of edible mushrooms of India, *Panoeolus* species with their black spores, though not extremely poisonous, can do considerable harm. Growers in Burma are therefore warned to avoid this mushroom.

Trials on the cultivation of the 'Common mushroom', known more popularly as 'English mushroom' (*Psalliota campestris*), carried out at Maymyo (a hill station situated at an altitude of about 3,500 ft.) from 1937 to 1940 proved to be very successful, but at Mandalay where the winter season lasts for a short period only, though some success was achieved, the cultivation was not found to be economical.

Under Burma conditions it has been found that the mushroom can be successfully grown without trouble in an ordinary shed and at a small cost. Conditions in India are rather more favourable than those in Burma for the production of this mushroom. In the present article it is proposed to describe the method adopted at Maymyo so that an amateur can easily follow it and grow mushrooms during his leisure.

## Method of cultivation

SITE: The bed was made in a plant-shed used for nursery pots in the Botanical Gardens, Maymyo. The shed had a wooden roof, latticed sides and gravel spread on the floor. The southern part of the shed exposed to wind was screened by tying a bamboo mat to the latticed side.

COMPOST: Six cartloads of fresh mule-dung was obtained on 7 June 1937. It was free from any disinfectants and contained about 25 per cent of bedding litter. The dung was broken up and piled in the form of a conical heap about 4½ ft. high, in the shed. The temperature of the heap at this stage was 122°F. The heap received its first turning on 12 June, that is, it was made into a new heap with the outer, exposed compost turned inside and the central compost outside. During this operation the compost was found steaming due to the high temperature (150°F.). Subsequently, the heap was turned every fourth day and watered once every ten days to keep the outer layer just moist, till it maintained a fairly constant temperature of about 72°F. for four days. The compost at this stage, when a handful was pressed, was found 'springy' and did not

[1] Any enquiries on the subject may be addressed to care of the Director of Agriculture, Burma, Government of Burma, Simla.

wet the hand. Such compost is ideal for the preparation of a mushroom bed. In the present case it took exactly three months (7 June to 6 September) from the time mule-dung was obtained to achieve the desired stage of the compost. It cannot be overemphasized that on no account should the bed be prepared so long as the temperature of the compost does not fall to about 72°F, distinctly warm to the touch but *not hot*.

PREPARATION OF THE BED : A flat bed 18 ft. long, 3 ft. broad and 10 in. high was prepared with the compost on 6 September. The compost was then pressed down to a depth of 8 in. the sides firmed and the upper flat surface levelled by means of a wooden plank.

SPAWNING : Immediately after preparation the bed was spawned with a No. 1 carton of 100 per cent Darlington's White Mushroom Spawn obtained from England. It is important that only a good quality spawn should be used. In other experimental beds where spawn obtained from certain other sources in India was used not a single mushroom was obtained. Most of the failures in India may be due to the use of defective spawns.

The spawn was broken into bits of about an inch in size and planted on the top of the bed in three rows about $1\frac{1}{2}$ in. below the surface. The side rows were 4 in. inwards from the edges and the distance between the pieces of spawn in a row was 10 in., the pieces of spawn alternating in position row by row as shown below :

Planting was done by slightly raising the compost by means of a knife and inserting a piece of spawn about $1\frac{1}{2}$ in. below the surface. After planting each piece, the compost was replaced and made firm by hand pressure. Finally the entire bed was levelled and made firm again by pressing down with a wooden plank.

CASING : The bed was 'cased' ten days after spawning. Well sifted old potting soil was spread evenly to a depth of $1\frac{1}{2}$ in. all over the top and sides of the bed. It was then levelled and lightly pressed down by means of the wooden plank.

WATERING : The surface of the bed was maintained just moist by watering lightly with a rose-can once a week and was never allowed to dry out. During the dry season, that is, February, March and April watering became necessary every three days.

### *Production*

The bed gave its first crop on 5 December when it produced 14 oz. of beautiful large mushrooms. The bed continued to yield till late April and a total of about 92 lb. of first grade mushrooms was produced. The best single crop was on 29 December when it yielded 12 lb. 4 oz.

Mushrooms are best picked in the afternoon. A fully grown 'button' just about to open out or a freshly opened mushroom is picked. To pick a mushroom, hold it near its base by the thumb and the first finger, rotate it side ways slightly and then pull out gently. Such mushrooms keep well for about 24 hours under ordinary conditions but if stored in a frigidaire will remain fresh for about three days.

This mushroom stands transport well. Several consignments were sent to Rangoon, a distance of about 450 miles by rail, and all these arrived in perfect condition. In each instance, the mushrooms with caps facing downwards, were packed in bamboo baskets lined with blotting paper. They were not sent in refrigerator cars.

### *Observations*

From September 1937 to February 1938, the bed temperature remained at 72-74°F. In the month of March, the bed temperature rose to 82°F. and extra shade and watering had to be resorted to enable the crop to develop. Without this precaution the crop would become brown and perish whilst still about the size of a pea. An extra casing of sand was given and watering every alternate day improved matters and it became possible to pick about 4 lb. of mushrooms between the end of April and the first week of May. Temperature conditions during the production period, the dates of pickings and the yield were as follows :

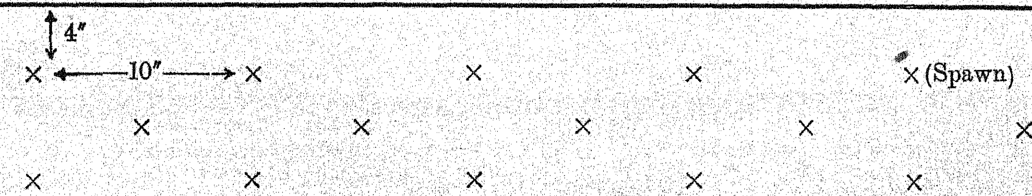

*Table showing temperature, date of picking and the yield*

| Date of picking | Maximum temperature | Minimum temperature | Yield lb. | oz. | Remarks. |
|---|---|---|---|---|---|
| 5.12.37 | 68 | 58 | 0 | 14 | The bed temperature remained between 72°F and 74°F. |
| 10.12.37 | 72 | 39 | 4 | 4 | |
| 15.12.37 | 68 | 40 | 3 | 8 | |
| 23.12.37 | 68 | 40 | 2 | 12 | |
| 29.12.37 | 76 | 56 | 12 | 4 | |
| 8.1.38 | 68 | 39 | 2 | 0 | The bed temperature remained between 72°F and 74°F. |
| 11.1.38 | 69 | 45 | 10 | 8 | |
| 13.1.38 | 67 | 40 | 1 | 12 | |
| 17.1.38 | 69 | 41 | 1 | 12 | |
| 24.1.38 | 70 | 38 | 2 | 12 | |
| 26.1.38 | 72 | 38 | 3 | 0 | |
| 28.1.38 | 72 | 40 | 6 | 0 | |
| 1.2.38 | 70 | 33 | 7 | 1 | The bed temperature rose to 77°F. during the last week of February. |
| 8.2.38 | 76 | 54 | 8 | 0 | |
| 16.2.38 | 76 | 54 | 8 | 12 | |
| 25.2.38 | 78 | 49 | 5 | 8 | |
| 4.3.38 | 78 | 40 | 4 | 8 | The bed temperature rose to 82°F. Extra shade and watering provided. |
| 9.3.38 | 82 | 52 | 2 | 12 | |
| 20.3.38 | 82 | 52 | 1 | 2 | |
| 15.4.38 | 88 | 62 | 2 | 1 | The bed temperature 82°F. |
| 26.4.38 | 88 | 62 | 1 | 2 | |
| | | Total | 92 | 4 oz. | |

## Cost

The cost of a carton of spawn landed by air-mail was approximately Rs. 4-8 and the cost of mule-dung, Rs. 3. The bed did not require the whole time services of a man, but the wages of one keeper at Rs. 16 for one month is estimated to be about the correct charge taking into account the time he actually spent. The total cost was therefore about Rs. 23-8 to raise 92 lb. of mushrooms which if regularly available would, it is thought, be worth Re. 1 per lb. in Maymyo. The prospects for such a subsidiary industry are therefore quite promising especially as the crop will stand transport to Rangoon.

*References* :—Bose, S.R. and Bose, A.B.(1940)—An account of Edible Mushrooms of India. Science and Cultuure 6 : 141–9.

Padwick, G. W. (1941) —Mushroom cultivation in India. Indian Farming, 2 : 363–6.

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# *What the Scientists are doing*

## IMPROVEMENT OF *TORIA* IN THE PUNJAB

TORIA is an important short-duration crop of the canal colonies, which brings ready cash to the farmer at a time when he needs money for paying his revenue instalment. Improvement in the yielding capacity of this crop can be effected by :

(1) *Seed Selection*

*Toria* is an extensively cross-pollinated crop, and therefore the isolation of pure lines analogous to those of wheat and gram is not likely to give result of any practical value. Mass selection is evidently the most convenient practice to pursue in order to effect improvement in this crop.

By following the method of continuous mass selection an improved strain of *toria*, named selection A, has been evolved in the Oilseed Section, Punjab Agricultural College, Lyallpur, which not only gives a higher yield of seed than the local unselected strains, but also has a higher oil content and is free from admixtures of seeds of allied *Brassica* crops. This strain is also fairly uniform in maturity and its seed is multiplied annually by the Department of Agriculture, Punjab, on a large scale so as to maintain a continuous supply of selected seed to the cultivators.

It may also be noted that the research work carried out by the Department of Agriculture, Punjab, in recent years has shown possibilities of evolving entirely new self-fertile or pure types of *toria* by crossing the common self-sterile forms of this crop with the self-fertile forms of *sarson* or other plants of the same family. This work will prove extremely useful in the further improvement of *toria* crop, but in the meantime farmers should replace their old seed with the selected seed obtainable from the Agricultural Department.

(2) *Better cultural treatment*

The greatest care is necessary with regard to the following operations :

(a) SOWING : It is often noticed that the crop suffers from low and un-uniform germination, as a result of which large blank spaces are left in the fields and consequently the yield is reduced considerably. To obtain satisfactory germination the following points should be kept in mind :

(a) The seed bed should be well prepared taking care that enough moisture is available in the soil at the time of sowing. Experience has shown that a seed bed having *vattar* somewhat on the wet side is absolutely necessary for obtaining a satisfactory germination of the seeds. Should there be a slight deficiency of moisture in the soil at the time of sowing, the germination of the seeds can be improved by keeping them in damp earth the night before sowing.

(b) In order to ensure uniform distribution, the seed should be mixed with double the quantity of moist earth and should then be broadcast by going over the field three times while scattering the seed at an ordinary rate.

(c) The seed should in no case be sown deep, nor should the surface be heavily pressed after sowing. The best method of mixing the seed with the soil, after they have been broadcast on a well prepared seed bed is to run a spring-tined harrow or a horse-hoe to a depth of 2 to 3 in. followed by a light *sohaga*. A bar-harrow should invariably be run over the field after sowing in order to break the crust that is likely to be formed by *sohaga*.

(d) As far as possible the sowing of this crop should be done in the evening, especially for early sowings, and also in case of lands where there is a slight deficiency of moisture. By doing so the soil moisture that rises to the surface during the following night gives a good start to the seeds in their germination. Sowing during the hot part of the day should invariably be avoided, as this causes loss of soil moisture which, in turn, reduces the germination of seeds.

(3) *Irrigation*

Consistent with the condition of the crop, the first irrigation should be delayed as far as possible, as this makes the plants stocky and more profusely branched. If the earlier growth of the crop has been normal, the best time for

the application of the first irrigation is when the plants start blooming. In dry season a second watering may be needed and it should be given preferably at the time when the flowering has proceeded about half way. Experience has shown that the application of water at late periods when most of the pods have fully developed, tends to bring about lodging which interferes with proper seed development and reduces the yield.

(4) *Manuring*

It has been definitely ascertained that if in the usual rotation in which *toria* follows wheat, the land is green-manured with *guara* before sowing wheat, the yield of *toria* increases considerably due to the residual effect of the green manure. Manuring with ammonium sulphate at the rate of 1½ md. per acre has also given significantly higher yield of seed than the crop to which no manure is applied. Experiments have shown that application of half the manure at sowing time and half at flowering time of the crop gives the greatest increased yield.

## CONDENSED MILK BY OPEN PAN METHOD

TWO of the most important methods available for the profitable utilization of milk are the manufacture of condensed milk and milk powder. By these processes the valuable nutritive portion of milk is reduced to a small bulk, facilitating its transport and storage. Recently some experiments have been undertaken at the Imperial Dairy Research Institute to investigate the possibilities of evolving a simple process for condensing milk which can be adopted under village conditions.

The apparatus used for making condensed milk by the open pan method is simple and consists of a double jacketed deep pan. The outer jacket is a 'built-in oven'. The inner jacket is removable. The space between the two is filled with fine sand to obtain uniform temperature.

Milk toned to 4 per cent fat is gradually heated to about 88 to 99°C. and is kept stirred with a wooden stirrer. When the desired consistency is reached, the heating and stirring are stopped and the contents of the pan rapidly cooled. When preparing sweetened condensed milk, about 15 per cent of cane sugar is dissolved in milk just before heating begins.

Condensed milk is now transferred to containers and sterilized before storage. Any available fuel can be used for heating milk and it is possible for one man to conduct all the operations.

The product obtained by this process compares very favourably with the imported material as regards flavour and colour.

# *What would you like to know?*

*Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.*

**Q. What is meant by the term *nigar* ?***

A. The practice of draining out water from paddy fields just before *Hathia* (corresponds with the period from about 28 September to about 10 October) is known as *nigar*. This practice is very common with the cultivators in the canal irrigated areas.

If *Hathia* rain is deficient, demand for canal water for paddy irrigation is increased very much : paddy plots having been drained out before *Hathia* as stated in para 1 above. By stopping *nigar*, water usually running to waste can be utilized for irrigating larger area of paddy in years of deficient rainfall.—B.P.A

**Q. Reference question and answer in the February 1944 issue of *Indian Farming*, p. 82.**

* *Indian Farming*, June 1942, p. 345, col. 1, line 21 from the bottom

**Your answer refers to milk boiled in a *closed* vessel and says such milk is safe, but one would like to know whether and to what extent, milk boiled in *open* vessel is safe.**

A. If milk is heated to the first boil and maintained at the boiling temperature for five minutes, the tubercle bacilli will be effectively destroyed. The question under reference seems to have been raised under the misapprehension that the general practice in regard to boiling in India is to boil it in open vessel. Attention is, therefore, invited to the article on the 'effect of heating milk of Indian cows and buffaloes' by Anantakrishnan, Noshir, Dastur and Kothavalla published in the December 1943 issue of *Indian Journal of Veterinary Science and Animal Husbandry* in which it is stated that heating milk to first boil in a closed vessel is the practice commonly followed in the Indian houses.—P.R.K

**COOLING OF MILK**

Milk cooled without delay will keep sweet many hours longer than another portion of the same milk, the cooling of which is delayed for an hour or two.—*Canadian Note.*

# What's doing in All-India

## PUNJAB

CH. KARAM RASUL, B.Sc.(AGRI.), ASSOC. I.D.I., P.A.S.
*Offg : Associate Professor of Agriculture, Punjab Agricultural College, Lyallpur*

THE season throughout the quarter under report April to June was abnormal. Rains accompanied by strong winds at the beginning of April were widespread. During May and June the season remained very hot and dry and dust-storms were common, and the unprecedented high temperature of 119°F. was experienced at Lyallpur which surpassed the previous record of 118·8°F. in 1914.

### Crops

*Wheat*: The area under this crop in the British districts and the Indian states is reported to be 99,38,000 and 15,63,700 acres showing respectively a decrease of 5 per cent and 10 per cent over the actual area of last year. The abnormal weather in April referred to above caused lodging in early sown and tall growing crop. A mild attack of rust and smut was reported from some districts. The attack of black mould was common. The combined effect of all these interfered with the development of grains and caused shrivelling, resulting in the reduction of yield which was normal to below normal, with a quality of grain below the mark. The total output of wheat which is estimated at 37,64,800 tons in the British districts and 5,40,000 in the Indian states is 10 per cent and 17 per cent lower than that of last year respectively.

The serious setback received by the wheat crop owing to unfavourable weather conditions coupled with the low average price of wheat i.e. Rs. 9 per maund in the Lyallpur market as compared with Rs. 9-13 during the corresponding period last year, will be reflected in the prosperity of the farming community in the province.

*Gram :* Like wheat the gram crop also presents a gloomy picture this year. The area under the crop as finally returned is 39,99,700 acres or 17 per cent lower than the actual area of last year. Excessive rains and high winds in the end of March and the beginning of April delayed harvesting somewhat and damaged the crop in several districts. Damage by hailstorm is also reported from some districts. The estimated yield is reported to be below normal to normal. The total outturn is 8,87,000 tons which is 19 per cent lower than that of the last year. The average price of gram per maund in the Lyallpur market during the quarter under review was Rs. 7 as against Rs. 9 in the corresponding period last year.

*Barley :* The area under the crop is reported to be 7,88,200 acres showing a decrease of 10 per cent from that of last year. The yield is normal to slightly above normal in irrigated and below normal to normal in unirrigated areas. The outturn is estimated at 2,10,500 tons or 25 per cent less than that of last year.

*Rabi oilseeds :* The yield is generally below normal to normal and the total outturn is estimated at 1,10,500 tons for *rabi* oilseeds and 2,800 tons for linseed showing a fall of 17 per cent in each case below last year's figures. The price of *toria* in the Lyallpur market which was Rs. 14-4 per maund as compared with that of Rs. 12-4 per maund last year was, however, favourable.

*Sugarcane :* The crop is receiving due attention but due to rain at the time of sowing, planting of the crop was delayed to some extent. The progress of both the freshly planted and ratoon crop is satisfactory, except for a mild attack of borer in some parts. The price of *gur* was unfavourable being Rs. 9 per maund on an average as compared with Rs. 11 in the corresponding period of last year at Lyallpur.

*Cotton :* The sowing of the crop was finished in time except in the south-eastern Punjab where rains in addition to being inadequate were not received at the proper time.

### Experimental

*Agricultural section :* In view of the shortage of kerosene oil and the increasing demand for vegetable oils to make good the shortage of fat in the dietary of the people and for providing

concentrates in the form of cakes for the cattle, the importance of growing oilseed crops is great, and any decrease in their area is a real danger to the country. In this respect *toria* which is an important oilseed crop in the Punjab occupying about 40 per cent of the area under oilseeds presents a gloomy picture as is shown by the following figures.

| Year | Percentage of area under *toria* to the total area under oilseeds | Year | Percentage of area under *toria* to the total area under oilseeds |
|---|---|---|---|
| 1933–34 | 45·13 | 1938–39 | 36·18 |
| 1934–35 | 41·19 | 1939–40 | 56·85 |
| 1935–36 | 42·07 | 1940–41 | 35·38 |
| 1936–37 | 44·87 | 1941–42 | 30·44 |
| 1937–38 | 42·59 | 1942–43 | 33·12 |

The fall in recent years in the area of this important oilseed crop grown mainly in the canal colonies is attributed to the high price of crops like wheat and American cotton which compete with it for irrigation water. The late sowing of the latter crop which has become common now along with some of its varieties requiring water late in the season might also be a contributing factor. The application of the results of irrigation experiment on the *toria* crop conducted at the Lyallpur Agricultural Farm given below will help in warding off a serious menace to the crop.

| Year of experiment | Kind of soil | No. of irrigations after sowing | Average Yield per acre per md. | Average rainfall in in. during the active period of growth |
|---|---|---|---|---|
| 1930–33 and 1934–39 | Light soil | Nil | 8·33 | 0·25 |
| | | One | 10·09 | |
| 1940–44 | Heavy soil | Nil | 11·68 | 0·39 |
| | | One | 12·02 | |

These figures would show that with the standard of cultivation followed on the farm, the *toria* crop without any irrigation after *rauni* (watering for preparation of land before sowing) gives quite a high yield in comparison with one watering on heavy soil. On light soil however application of one watering after *rauni* is better than no watering but the yield in case of the latter is not less than the average yield obtained by the farmers. Since the rainfall of most of the *toria* districts of the Punjab during the period of active growth is almost the same as at Lyallpur, where the experiment was carried out, it is reasonable to conclude that the results are applicable to other *toria* growing districts of the Punjab as well. Moreover, they are particularly valuable for introducing *toria* crop on inundation canals which cease to flow early and irrigation of the crop after *rauni* is out of the question.

A similar experiment performed on the water requirements of crops with measured amounts of water also points to the conclusion that *toria* crop of average standard can be grown in the canal colony without any irrigation after *rauni* of 5 in. depth with the standard of cultivation followed at the farm.

*Miscellaneous :* With a view to utilize to the full extent the skill of the Punjab farmer along with other resources for increased production by making available to him an adequate amount of water, the life-blood of crop production, the Punjab Government have drawn up four new irrigation projects, to be located on the Jumna, Sutlej, Bias and Chenab basins. It is claimed that for the next 75 years no irrigation scheme will be necessary, that the new projects along with the Thal project which is already under construction will be completed in 15 years, and that with their completion the Punjab will have every acre adequately provided with irrigation water. For the construction of Diangarh Dam on the Chenab and the Bhakra dam on the Sutlej, the Government of the Punjab are negotiating with the Kashmir and the Bilaspur Governments. In addition to ensuring an adequate supply of water for crop production, the enormous amount of hydro-electric power which will be generated will be utilized for the development of industries to absorb the growing population.

Research work on dry farming has been completed at the Agricultural Farm, Rohtak, and results of great practical utility have come to light. In order to acquaint with the latest technique the district work staff, the main link between the laboratory and the field, a course for the staff of the Hansi circle was held at Rohtak on 17 and 18 June 1944. During the course of training the chief principles and practices were explained by a series of lectures and the results obtained during the Dry Farming Research Scheme at Rohtak were fully described. Serious efforts are being made to introduce improvements in the rain-fed areas as far as possible according to scope and conditions.

A locust swarm passed over Hansi farm on 29 June, 1944. Anti-locust organizations have been warned to be on the alert.

Frequent wind-storms resulted in severe shedding of mango fruit in the Jullundur circle particularly in the Hoshiarpur district.

### An agricultural show

In April, an Agricultural show was put up by the Agricultural Department in the War Services Exhibition held at Lahore.

Improved varieties of wheat and rice, different methods of sowing cotton and specimens of different varieties, manufacture of sugar by open pan system, high-yielding types of millets, seeds of various fodder crops, important medicinal and economic plants, various oilseeds, improved methods of growing seasonal vegetables, etc. were so many interesting features of the exhibition. Under the section 'marketing' informative charts showing the war effort of the Punjab were exhibited. A miniature garden showing the correct method of the layout of a 25 acre fruit garden, practical demonstrations on the manufacture of fruit products, dehydration of fruits, etc. were features of the 'fruits' section. Besides, important modern dairy appliances, charts relating to the value of milk as food and consumption of milk in different countries of the world, and the modern methods of butter manufacture were demonstrated. There were several other sections relating to implements and machines, poultry, agricultural chemistry, agricultural entomology, pisciculture etc. The whole show was organized under the direct auspices of Sultan Malik Ali Noon, Director of Agriculture, Punjab.

# SIND

H. S. Bawa, M.R.C.V.S.
*Veterinary Investigation Officer, Sind, Karachi*

THE primary function of the Veterinary Department is to control diseases in livestock and thus to assist improvement in cattle, sheep and goat breeding. No improvement in livestock can ever be attained, unless they can be saved from the ravages of disease.

A scheme for the investigation into animal disease conditions, has been in progress in Sind for over seven years. From 1943 the scheme is financed on a 50:50 basis by the Imperial Council of Agricultural Research and Sind Government. Investigation work is carried out in close collaboration with the Imperial Veterinary Research Institute, Mukteswar and Izatnagar. The object of the scheme is to study the existing conditions in order to improve or modify the methods of treatment and control of animal diseases, to investigate new or obscure diseases for determining the cause, to effect remedial measures, and finally to take steps to carry the result into practice for the benefit of the farmers. This scheme has already put the Civil Veterinary Department in a better position as regards control work of certain contagious diseases.

### Efforts to combat diseases

Rinderpest, the worst scourge of cattle, used to be the terror for cattle owners. It comes in a wave every three years and used to pass through the whole of Sind, causing havoc. The disease generally infiltrates into Sind from Bhawalpur, Cutch and the Rajputana states, as it is generally seen that the first districts to be affected lie on the borders of these states.

The Sind Veterinary Department is well equipped now to deal effectively with the control of rinderpest and produces its own goat tissue virus vaccine at the Veterinary Laboratory, Karachi. Terrors of this disease now are things of the past. The spread of the disease can be nipped in the bud by protective inoculations with goat tissue virus vaccine, if full cooperation of the *maldars* is forthcoming. The rapidity with which this method has gained popularity is borne out by the increasing number of vaccinations.

Next in importance rank two other diseases, haemorrhagic septicaemia and liverfluke, while the incidence of anthrax in cattle is sporadic and comparatively low. Black quarter is of very rare occurrence. They are usually controlled by inoculations of anti-serum with beneficial results. In enzootic areas haemorrhagic septicaemia vaccine has been tried with encouraging results. Administration of carbon tetrachloride in sweet oil has been found to be a very effective method of treatment against liverfluke infestation, in all class of animals. Safe and effective doses for each

class of animals have been experimentally worked out and now the following scale of doses are used by veterinary assistant surgeons in the field : goat and sheep 1 c.c., cattle 6 to 8 c.c. and buffaloes 8 to 12 c.c. The treatment with this drug has become very popular and *maldars* are taking full advantage of it. During the year 1943-44, 7,155 cattle, 9,683 buffaloes, 15,880 sheep and 19,582 goats were treated with carbon tetrachloride. Even the small *bania* shops in the villages till lately used to stock carbon tetrachloride as they had ready and profitable market for it. The villagers are well versed with the doses and mode of administration of this drug.

Treatment is given free throughout Sind, except in two districts viz. Hyderabad and Larkana, where one anna per dose is charged for buffaloe and cattle and one pice per dose for sheep and goats.

### *Reserve forests*

There are extensive forest areas in Sind along the banks of the river Indus, wherein grazing is allowed to the livestock on payment of a nominal fee. In some of these forest areas anthrax in sheep and goats is found in enzootic form. It is of great interest to note that cattle of those areas usually do not contract the disease. Serum inoculations have not been able to free the area of the disease. It has been decided to vaccinate with spore vaccine all sheep and goats this year, before they are allowed to enter the forest area after *abkalani*. Twenty-five sheep and eight goats were vaccinated with spore vaccine as an experiment, to see if this mode of vaccination was safe for such class of animals. All vaccinated animals showed local reaction and no untoward symptoms followed.

### *Sind Cattle Disease Act 1940*

The Sind Cattle Disease Act 1940 was finally adopted by the Sind Government in July 1942. Prior to this act there was no legislation whereby movements of the diseased cattle could be prevented or checked, nor one could force the cattle-owners to get their animals protected during the outbreaks. This Act now gives ample powers to the Civil Veterinary Department and puts it in a far better position to deal efficiently with control work of contagious diseases. For the time being this Act applies to only five diseases viz. rinderpest, haemorrhagic septicaemia, anthrax, black quarter, and contagious abortion. Recently this Act was applied to two villages on the outskirts of Karachi where the animals were dying of rinderpest and owners refused to let us vaccinate their animals and prevent their movement. On the application of this Act, owners were compelled to get their animals inoculated and confine their movements to the limits of the village. The Act provides a penalty for those who contravene the provisions of the Act; such persons shall, on conviction, be punishable with a fine not exceeding Rs. 50 or, in default, with simple imprisonment for a term not exceeding one month.

## NORTH-WEST FRONTIER PROVINCE

P. C. RAHEJA
*Sugar Cane Specialist, Tarnab*

THE last two crops of wheat had been hardly above the normal. Therefore, in the year 1941-42 and 1942-43 the province had to import small quantities of wheat from the Punjab and Sind. Last season the sowing time was completely dry and the small area seeded under the *barani* conditions had to depend on a very precarious soil moisture. A fair proportion of the sown area could not withstand the extreme drought that prevailed upto mid-January, only when good showers were received. Cereal crops that could pull through the drought experienced good season right up to the ripening stage only to meet with early hot winds which spread havoc since grains immaturely shrivelled. The irrigated crop also suffered due to lodging and heavy rust attack because of the wet weather during the months of January and February. Consequently the province began to feel the pinch of short crop from the very onset of the preceding harvest. Thus wheat, in very large quantities, is being imported from the Punjab and Sind.

### *Grow more wheat scheme*

This has set the provincial Government athinking and with financial assistance from the Government of India they propose to

undertake a comprehensive scheme for the distribution of C591 wheat seed. Through the good offices of the Food Department of the Government of India import of pure seed of C591 will be effected to cover an area expected to yield the normal deficit of one lakh tons. A 'Grow More Food' officer has been appointed to coordinate these activities and accelerate the progress towards making the province self-sufficient in respect of food and vegetable crops.

### *Citrus fruit orchards*

As a result of a keen demand for citrus fruits several fruit nurseries have been established and are distributing citrus seedlings in thousands. In spite of this over 70,000 plants were said to be imported from the Punjab and the United Provinces. Yet it was difficult to meet the demands of citrus growers. This demand was widespread not only in the settled districts but also in the agencies. The Malakand Agency imported over 20,000 plants of citrus. Blood red malta orange and sweet lime were in greater demand than other types of citrus. Plants with Seville orange stock were given preference and were sold at much higher prices than those grafted on the sweet lime stock.

### *Deciduous fruit nursery*

Though a distinct preference to citrus against deciduous fruits is noticeable, it is worth recording that few deciduous nursery growers had to carry over any plant. All plants were sold off at fancy prices. The internal demand was far greater than from outside the province. Peaches were more in demand than other deciduous types. In spite of Departmental advice few deciduous nurserymen have so far registered themselves. Therefore, an accurate record of sales and area is not possible at present.

### *Seed collection of wild rubber plant*

The wild rubber-bearing plant (*Cryptostegia grandiflora*) was first noticed growing in the Cantonment area of Dera Ismail Khan. In all 360 plants were counted growing on road sides and in residential bungalows. In April last seed collection from those plants were carried out. The Departmental staff has been instructed to be on the look out for such plants in other parts of the province. For regular and systematic planting nurseries have also been started.

### *Sugarcane research and development*

Experimental work on nitrogenous manuring showed significant difference in cane yield of the crop. Those results were analyzed by agro-biologic methods, and the economics of increasing doses of nitrogenous applications were determined. The evidence indicates that the optimal dressing for two soil types, sandy loam and loam, is 50 lb. of nitrogen although the response at 100 lb. was equally good. From a farmer's standpoint an economic dose will be about 50 lb. and not 100 lb. per acre.

Variety Co419 is finding favour with the cane growers. In the last planting season there was an insistent demand for its seed. As its *gur* is much less sourish it is liked for use in tea. This is a contributing factor to its popularity besides the high yield and better extraction of juice from cane. Owing to high tonnage returns per acre its relative water requirement is low. This fact is appreciated by intelligent farmers.

As a nucleus of sugarcane development work, a beginning has been made with the funds made available by the management of the sugar factory, Takhati-Bhai. The staff of the sugarcane development scheme has been entrusted to carry out large scale distribution of Co419 seed ; conduct varietal trials with Co419 against Co290 ; experiment with manures in order to confirm the results obtained by the scheme, the doses tried being 0, 50, and 100 lb. of nitrogen per acre ; demonstrate the use of improved implements and conduct a survey of the sugarcane area with a view to organize cane supplies according to the richness of the ratoons. About 6,000 md. of seed was distributed in the planting season ; six varietal trials are in progress and 14 demonstration plots have been laid out. A survey of the sugarcane area is to be completed by the time the factory will take up crushing of cane in hand.

### *Breeding of peaches*

As it is, 6A peach ripens rather late in the season and is favoured by fruit fly for infestation. Of all the peach varieties it is the one which possesses all the fine characters of high bearing, plumpness, delicious taste, soft skin, stone-free core, etc. except earliness. To evolve a new variety with the characters of 6A and the earliness of Red French Early, a cross between these has been carried out. A good setting of stones has been obtained in the cross. This is the first attempt in crossing peaches at

the Research Station. The performance of the seedlings will be tested by grafting the branches.

### *Research on pulses*

The southern districts of the province possess very considerable area under gram while in the northern districts pulses other than gram occupy a large area. Research on pulses has, therefore, been located according to the importance of the crops raised in the southern and northern districts of the province. Experiments on gram are being conducted at Serai Naurang and those on *mung*, *mash*, various types of beans, *arhar*, moth, soyabeans, etc. are in progress at the Agricultural Research Station, Tarnab. Besides the varietal selection work the programme includes experiments on mixed cropping under irrigated and unirrigated conditions.

# RURAL DEVELOPMENT IN VADIA

T. V. Vyas

*Director of Information, Vadia State*

During the last World War, the markets were very high and the agriculturists of the State requested the late Darbar Saheb, father of the present ruler, to settle cash assessment instead of the share system. Darbar Saheb agreed to that proposal and the *Vighoti* System was introduced. For about three to four years, it went on all right, but after that due to scanty rainfall and slump in the markets the agriculturists, instead of being free, were buried under debts. State as well as merchants' dues began to rise. Meanwhile, after the expiry of the late Darbar Saheb, the present ruler Darbar Shree Suragwala ascended the *gadi*. He immediately took up the question of the cultivators. First he passed orders that Rs. 100 would be credited to any debtor who would pay Rs. 50 thus reducing the amount of debt of the agriculturists; but scanty rainfall and lower rates of agricultural produce made them helpless. And at the request of the cultivators the cash assessment system was replaced by the old share system. As it was the main object of the Darbar Saheb to free the cultivators from debts somehow or other, the State Dewan Mr K. J. Dewan toured round the villages and studied the problem by coming into direct contact with the agriculturists. He then put forward a proposal before Darbar Saheb who agreed to it and empowered him to settle the question. Mr Dewan then moved from village to village, settled the dues looking to the condition of each cultivator and his produce and thus within a period of two years, 95 per cent of the agriculturists were made free from State dues. Then he put forward a proposal to settle the dues of the moneylenders. Committees were appointed for each district headed by the Judicial Officer, who after hearing both the parties, decided the claims with the help of the members of the Committee. Besides being relieved from State debts, the cultivators were also relieved of the merchants' dues and thus today the State is proud to claim that 95 per cent of the agriculturists are quite free from debts. The agriculturists work hard, produce more, get good prices and thus the villages which were in a tottered condition before appear all gay and lively now.

Over and above this, best quality seeds, selected from the best types are being supplied by the State to the cultivators at cost price. Also two cultivators were deputed to study modern methods of farming. They are now moving among the villagers and are persuading and advising them to adopt new methods. It is quite certain that this will have a very good effect within a short time.

The *Gramya Panchayat System*, recently introduced, helps the cultivators to ventilate their grievances, mitigate their hardships and settle petty disputes without incurring any expenditure.

Rupees one lakh have been set apart for post-war rural reconstruction. Even a recurring grant is sanctioned for the digging of new and *pucca* wells, and the construction of buildings and reservoirs.

# MILK RECORDING NEWS

RECORDS have been received from six village milk recording centres for lactations completed by 26 cows and 31 buffaloes under record during August 1944. The average lactation yield for cows was 2,834 lb. and for buffaloes it was 4,714 lb. Records for individual centres are given below :

### *Hariana cows*

Beri area, District Rohtak : Eighteen cows completed their lactation during August 1944. Their average yield was 2,902 lb. with a maximum yield of 4,658 lb. and minimum yield of 1,987 lb. Selected records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| BR.13 | Risalo S/o Kanhia | 3 | 15.10.43 | 285 | 2,945 | 17 |
| SR.4 | Nana S/o Arjun | 4 | 12.11.43 | 270 | 3,348 | 21 |
| BS.5 | Ram Kala S/o Gangaram | 2 | 15.10.43 | 300 | 3,140 | 21 |
| BH.1 | Kanshi S/o Thathar | 3 | 21.10.43 | 304 | 4,551 | 23 |
| BH.7 | Ram Kala S/o Arjun | 3 | 31.10.43 | 287 | 4,658 | 25 |
| KW.5 | Harchand S/o Shadi | 4 | 3.10.43 | 322 | 3,296 | 16 |
| KW.285 | Mangli S/o Gordhan | 5 | 11.10.43 | 317 | 3,230 | 16 |
| SD.10 | Jaglall S/o Thana | 4 | 12.9.43 | 285 | 2,850 | 17 |

### *Local cattle*

Travancore: No lactation was completed during the month by cattle under record in this area.

### *Sindhi cows*

Karachi area, Sind: Only two cows completed their lactation under record during August 1943 yielding 4,937 and 3,609 lb. in 225 and 401 days respectively.

### *Kankrej cows*

Sanand, Ahmedabad: Only one Kankrej cow completed a lactation yielding 2,666 lb. in 295 days.

### *Local cows*

Chata area, Muttra, U.P.: Five cows completed their lactations during August under record averaging 2,046 lb. The records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 948 | Moh. Swaleh | 1 | 5.3.44 | 147 | 1,117 | 8 |
| 281 | B. Nityanand | 6 | 15.5.43 | 466 | 2,931 | 11 |
| 198 | Ramchand | 4 | 2.8.43 | 365 | 2,745 | 9 |
| 378 | Gayasi | 1 | 29.8.43 | 351 | 2,011 | 8 |
| 246 | Umrao | 3 | 27.9.43 | 321 | 1,425 | 6·5 |

### *Local buffaloes*

Chata area, Muttra, U.P. : Twelve buffaloes completed their lactation during August averaging 3,269 lb. The maximum and minimum yields were 4,220 and 2,052 lb. Selected records are as under :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 211 | Kanni | 2 | 3.7.43 | 398 | 4,220 | 15 |
| 122 | Padmi | 1 | 26.7.43 | 371 | 3,650 | 13 |
| 178 | Ramchand | 1 | 9.8.43 | 360 | 4,131 | 14 |
| 310 | Ladua | 4 | 3.8.38 | 377 | 4,082 | 15 |
| 305 | Harpal | 2 | 31.8.43 | 342 | 4,185 | 20 |
| 261 | Abdulahet | 3 | 5.7.43 | 405 | 3,540 | 14 |

### *Murrah buffaloes*

Meham area, District Rohtak, Punjab: Nineteen buffaloes completed their lactation under record in this area during August 1944. The average yield was 5,626 lb. Maximum and minimum yields were 8,292 and 4,435 lb. respectively. Selected records are as under :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. |
|---|---|---|---|---|---|
| MM.142 | Maya Ram S/o Beg Raj | 3 | 17.10.43 | 319 | 7,448 |
| MM. 63 | Jaga S/o Gulde Singh | 5 | 17.9.43 | 332 | 6,014 |
| MM. 71 | Teli Ram S/o Chan Sukh | 2 | 3.11.43 | 295 | 6,090 |
| MM.271 | Ram Singh S/o Naro Ram | 2 | 5.9.43 | 331 | 6,034 |
| ND. 25 | Mewa S/o Shiva Lal | 4 | 1.10.43 | 320 | 6,114 |
| MA. 73 | Dr. Hari Singh | 5 | 1.10.43 | 299 | 6,216 |

# The Month's Clip

## CREATING SOIL FERTILITY

STANLEY B. WHITEHEAD

SOIL fertility is the 'current account' of the gardener. Gardening is based on creating greater soil fertility, thereby enabling the soil to nurture finer flowers and better crops. Fertility, as such, is a fluctuating asset, varying from day to day and from season to season. At harvest, the fertility balance is at its lowest, depleted by the plants in the fullness of their growth. Autumn is traditionally the season when the restoration of soil fertility should have our critical attention.

Every garden soil is a combination of five things the original mineral material or rock particles, organic plant and animal remains, micro-organisms and forms of soil life, moisture, and air. Out of the inter-activity of these five constituents under the influences of weather and climate comes the ability of the soil to nurture plant life.

As the result of physical, chemical and biological action, a soil solution of water and soluble mineral nutrients is formed from which plants obtain their food. The kind, concentration and combination of these nutrients or mineral salts are a measure of a soil's fertility.

Practically, the problem of creating more fertility is solved in four ways ; by cultivation, by liming, by organic manuring and by fertilizing the soil. Collectively, these operations enhance fertility by improving the composition of the soil by bringing about a better balance between its five primary constituents.

Autumn is the season for spadework. Digging and forking disturb the soil, expose it to weathering action and admit air. Greater chemical and biological activity follows and fertility is temporarily increased. But digging alone leads only to exhaustion of the soil's fertile reserves. The soluble salts released by autumn cultivations are washed from the rooting levels of plants by winter rains unless we add organic matter to sop them up and retain them. Cultivation should, therefore, go hand in hand with organic manuring. The most fertile area of the soil is near the surface. Digging extends the fertile zone downwards, but only when it goes hand in hand with manuring and liming does deep digging really pay. Our autumn digging should do more than shake up the soil, it should improve the mixture and the structure.

We name soils by their mineral particles. If large particles predominate, we speak of gravelly or sandy soil, while a preponderance of fine particles gives silt or clay soil. A sandy soil is of coarse texture and light to work since it does not hold much water. A clay soil is of fine texture and heavy to work. The mineral part of a soil is, however, infertile. Not until organic matter is added and humus is formed does the soil become fertile, and its structure formed for the maintenance of fertility. Soil texture relates to the size of its particles, but structure describes the way in which the particles are arranged. In all soils it is desirable that the particles should granulate or crumb together forming small spheres or granules in which soil processes can work with maximum effect.

Organic matter is a constant need of soils because it leads to the formation of humus—the key to fertility. Humus is all things to all soils. It cements sand fragments together and enables them to hold water. It also crumbs clay particles and makes the soil structure more open. To sand it brings more moisture, to clay more air. In both cases the soil conditions are improved to enhance both chemical and biological activity and create more fertility.

At this season, all organic material is grist to the humus-forming mill of all soils—manures, compost, green debris, peat, spent hops, etc. Fresh or rotted, they may be added to vacant ground, to be decomposed within the soil during winter. The presence of organic matter in the soil during the next few months will slow up losses of soluble salts in the drainage water, since it acts like a sponge. It will also provide food for bacteria, earthworms and other soil life which make invaluable contributions to the general fund of soil fertility. Calcium (lime) is constantly lost from cultivated soils and should

be replenished. Lime is a source of plant food, a builder of fertile structure, cementing sand, crumbing clay, and speeding up organic decay and humus formation. Ground limestone is excellent for all soils, though ground chalk suits sand better, and hydrated lime is highly convenient to distribute.

The soil is a poor storehouse for most artificial fertilizers. Only the slow-acting bonemeal, hoof and horn, shoddy, leather dust and basic slag are eligible for autumn use. They are acted upon by the soil population and their nutrients are available by spring. Any soil that is dug and manured in autumn, and thereafter surface-limed according to its requirements, will have new fertility by the spring in the shape of a nutrient soil solution within a settled, well-knit soil structure ideal for plant roots to explore and exploit.—Abstract from *The Field*, October 7, 1944.

## DEHYDRATED FOODS

AMONG the high lights in recent American developments in the dehydrated food industry have been the fifth annual conference of the Institute of Food Technologists at Chicago, an elaborate series of investigations on the packaging and storage of dehydrated foods by the Continental Can Company of Chicago, and the further development of the vacuum method by the Vacuum Dry Company of Oakland, California.

The papers read at the Chicago conference included one by R. Wilson, who said that nearly all dehydrated fruits and vegetables are definitely perishable. The best results are obtained by gas packing in hermetically sealed containers, so that not more than 1 per cent of oxygen is present and this should be preceded by a certain amount of vacuumizing. Compression of dehydrated foods in his view, though strongly recommended in some quarters, has both advantages and disadvantages, it might offer some post-war possibilities from a merchandizing standpoint, but, on the other hand, there is some risk of damage to the product. Another point emphasized at the conference was the urgent need of properly trained food technologists, of whom there is said to be a scarcity in the United States.

*Research*

The Continental Can Company's programme of investigation was designed to determine the effect on the keeping qualities of dehydrated vegetables and one or two fruits of (1) packaging, (2) storage temperature and period, and (3) moisture content. Those selected for test were products purchased in largest quantities by the Government in 1942-43 and recommended for study by the Q.M.G. Subsistence Research and Development Laboratories—namely, apple nuggets, beet, cabbage, carrots, cranberries, hominy, onions, rutabagas, sweet potato, tomato flakes, tomato juice cocktail, and white potatoes. Four types of packaging were tested, of which three were in No. 1 tinplate cans hermetically sealed in air, nitrogen, and carbon dioxide respectively. The fourth was a carton plus inner bag heat-sealed in air.

Storage studies were carried out for at least a year and sometimes longer if results warranted. Very careful attention was given to the determination of quality and nutritive factors—namely, flavour, colour, odour, moisture content, gas analysis, enzyme activity, and vitamin content. This last was of special interest and importance, and related to ascorbic acid (vitamin C), carotene (pro-vitamin A), thiamine hydrochloride (vitamin $B_1$), and riboflavin (vitamin $B_2$). Some of the results so far obtained can be summarized as follows :

Apple nuggets, when reconstituted to make apple sauce, are a highly acceptable food product, although poor in vitamin content, as is to be expected since the original fresh apples are also comparatively poor in this respect. The nuggets must be kept in an oxygen-free atmosphere at temperatures not exceeding 80°F. if storage for more than a year is required. Gas packing was best for preserving good flavour, and there was little appreciable difference between nitrogen and carbon dioxide. Some moisture was absorbed in the carton packaging.

*Powdered dehydrated cranberries*—After one year of storage it was found that these provided a satisfactory food product, and can be reconstituted to make a sauce comparable with the fresh fruit. They also have a fair to good content of ascorbic acid (vitamin C).

*Dehydrated carrots*—These, too, can be reconstituted to yield an attractive food comparable with the fresh vegetable, including the high carotene (pro-vitamin A) content of the original, together with a good content of $B_1$ and $B_2$. The vitamin content, flavour, odour, and colour can be preserved with little change for at least six months, and possibly a year, if kept in an oxygen-free atmosphere at a

temperature not exceeding 80°F. This latter condition is particularly important for carrots.

*Dehydrated cabbage*, though not quite comparable with the fresh vegetable in the matter of flavour, is yet an excellent source of vitamins C and B, and can be kept for six to twelve months at temperatures not exceeding 80°F.

*Dehydrated tomato juice, cocktail*—This provides an acceptable and valuable drink when rehydrated, and is a very good source of vitamins C, B, and A.

*Vacuum dehydration.*

In the production of dehydrated fruit for the United States armed forces the methods used by the Vacuum Dry Company and a few others have played an important part. By vacuum dehydration it is claimed to be possible to reduce moisture content to 1 per cent. Though apples are the principal fruit treated at present, most other fruits can be similarly dealt with, including apricots, dates, figs, peaches, pears, prunes, and nectarines both in the nugget and powdered form. Raisin puffs (aerated form of nugget), all-fruit, mincemeat, and Norwegian fig pudding have now been introduced, and other puddings and beverages are under experiment.

The vacuum chambers in which both nuggets and compressed ribbons are dehydrated comprise eight chambers 5 ft. in diameter and 8 ft. high, ranged in two banks or units of four chambers each. Inside each of these is a stack of 32 radiator coils suspended between four upright header pipes. The casing or shell of the chamber rests on rubber-gasket stages, and the chambers are opened by elevating the entire shell with counterweights. Thermocouples are provided for temperature checks at 15 minutes intervals. After lowering the shells tightly on to their rubber foundations the vacuum and heat valves are opened, and within five minutes the required temperature is attained, together with a 28 in. vacuum.

*Prospects of the business*

In regard to post-war prospects of the dehydration business generally it is realized that the future of dehydrated food products is somewhat controversial, but the problems involved appear to be fairly clearly envisaged. The quality of the finished product on the consumer's table, ease of preparation, variety of uses, and cost have occupied the American dehydration industry for some time. In the case of the Vacuum Dry Company plans have been made to cultivate three markets: consumer, industrial and commercial. The company believes that the consumer market will be receptive to vacuum dehydrated fruits, and it intends to rely largely on a combination of mass-volume specialities for an entering wedge to this market.

The Bureau of Agricultural and Industrial Chemistry of the United States Department of Agriculture is continuing its earlier work on the design of small dehydrating units for use on the farms and in the homes. They include the multistage, tunnel, and other types.

Also the Tennessee Valley Authority, in collaboration with the University of Tennessee, has recently developed a kitchen model dehydrator, to enable owners of small gardens to preserve their excess products. This has a capacity of 10 to 25 lb. of fruit or vegetables. Heat is supplied by five 200-watt electric lamps, and an ordinary household fan circulates among the glass trays.

*Blanching effects*

A. S. Crafts, of the College of Agriculture, University of California, has recently studied the effects of blanching used in the dehydration of many vegetables and now under consideration for fruits. It would seem that the most important physical change is the displacement of inter-cellular air, but this is only one of the many physical and chemical changes. Microscopical examination of blanched and unblanched tissues is said to provide a complete picture of what happens. Generally it may be said that steam or hot-water blanching causes certain losses from the tissues, especially in the case of fruits that bleed badly, such as cherries, peaches, and prunes. The losses from large fruits requiring prolonged blanching may also be severe. Even in these cases, however, tests indicate that improvements in appearance and keeping qualities more than balance the loss. Much of the loss may be sugar, which is comparatively easy to replace.—*Trade and Engineering*, October, 1944.

## SOYBEAN VARIETIES AND ADAPTATION

SOYBEAN varieties cover a wide range in maturity. There are varieties that mature in 100 days or less while others require up to 150 days or even more. Obviously such widely different varieties are adapted to different areas and it is the task of the soybean grower to choose that particular variety best adapted to his own conditions, states

F. Dimmock, Central Experimental Farm, Ottawa.

It has been demonstrated that the best variety of soybeans to grow is the one that will just reach maturity in the average season. Normally a variety that matures too early and does not make use of the full season will yield less than one that does. Similarly a variety that is too late and requires longer than the average season in which to mature will likewise yield lower than the variety that requires just the full season. In other words the best variety is the one that just fits the season or, as it is usually called, is best adapted.

This question of variety adaptation affects not only the yield, but influences also the quality of the seed. In a crop that is intended for seed, the plumpest and most attractive seeds come from the variety that normally matures in the average season. Seed from a variety that is too early is often small, shrunken and unattractive, while that from a variety that is too late is normally of poor colour, tinged with green and high in moisture, which adds to the problem of storage and may result in poor germination. It is claimed that immaturity affects the quality of the protein and oil in the beans and makes them less desirable for commercial use.

It may be that the grower in certain areas may wish to follow his soybeans with some other crop, such as fall wheat. Then he may have to use a somewhat earlier variety than he otherwise would. But where the soybean crop is to occupy the land for the entire season, the best results will come from the variety which just fits the average season, being neither too early nor too late.—*Department of Agriculture, Canada.*

## ZEBU CATTLE FOR AUSTRALIA

The Council for Scientific and Industrial Research will shortly report on the use of half and quarter-bred Zebu cattle to assist settlement in tropical parts of Australia, the Minister in Charge of the Council (Mr Dedman) said recently. Two main reasons why British cattle were not at their best in these areas, Mr Dedman said, were because body temperature rose above normal and because they suffered badly from 'tick'. On the other hand, the Zebu breed suffered no discomfort and was completely tick-repellant. Half-bred Zebus got a few ticks but were never worried while susceptibility of quarter-breds was dependent upon their type of coat. Zebu cross cattle appeared to be more tolerant of drought conditions than other breeds, and it had been found that they reached marketable size about a year earlier than British breeds. The carcasses compared favourably. Use of Zebu blood for raising the yield of dairy cows in the north, Mr Dedman added, was an attractive possibility that still awaited study. The only factor likely to restrict the usefulness of Zebu in Australia was their temperament, but this might be overcome by careful handling, as American experience had indicated, Mr Dedman added. The first systematic importation of Zebu cattle was in 1933, when the C. S. I. R. in cooperation with several pastoralists imported eighteen pure-bred and one crossbred from America. In 1941 there were more than 8,000 of the cattle, mostly quarter-breds. The C. S. I. R. supervised this crossbreeding on the properties of four Queensland pastoralists.—*Dairy News Letter, Canada*, April, 1944.

## DAIRYING IN NIGERIA

DAIRYING is developing in Nigeria. A clarified butter called ghee has always formed an important part of the diet of Africans, and it was made by the nomadic tribes which constitute a large proportion of the population of northern Nigeria. These tribes continually moved about with their large herds of cattle. The authorities began a drive to bring about the making of a purer ghee, and when the manufacture had improved small quantities were exported. Then small mobile milk-buying units were set up on the roadsides. The milk purchased was put through separators on the spot and the cream taken to dairies specially built for butter making. Following success of the mobile milk-buying units, permanent depots were set up, although some of the roadside units are still operating. Since the establishment of milk-buying stations, many of the people—formerly amongst the most nomadic in the world—have voluntarily settled on the land near the depots.—*Dairy News Letter, Canada*, April, 1944.

# New Books and Reviews

## TYROGLYPHID MITES IN STORED PRODUCTS-I

By M. E. Solomon (H. M. Stationery Office, London 1943, pp. 36, 9 d.)

The Tyroglyphidae, popularly called 'flour mites' or 'cheese mites' comprises a number of cosmopolitan species, e.g., *Tyroglyphus farinae*, *T. dimidiatus*, *Glycyphagus cadaverum*, *Tyrolichus casei*, *Carpoglyphus laetis*, etc. which are pests of various stored food-products like grains, flour, dry fruits, cheese, fermenting tobacco, etc. The damage caused by these pests is often very considerable and numerous workers in different parts of the world have been engaged on their study to discover methods for their control. As a result of this, very large amount of literature has accumulated which is widely scattered being published in a variety of languages. Any attempt therefore in preparing a review of the information available on these pests would be welcome especially under the war conditions when the problem of storing food materials is acute. This task has been ably carried out by Mr Solomon in a pamphlet published by the Department of Scientific and Industrial Research in the United Kingdom. Mr Solomon has paid particular attention to the papers published during the past 40 years or so, Michael having listed and discussed at length in 1901 and 1903 the work of the previous century.

After giving a brief account of the systematics, distribution and important anatomical features of the group, the author enters into a detailed discussion of the life histories of the various injurious species. A striking feature of the life-history of this group consists in the fact that the egg stage is followed by a larval and three nymphal stages leading to the adult individual. The active nymphal stage is called 'hypopus'. A section is devoted to the optimum physical conditions of atmosphere under which these mite pests flourish best and reproduce most actively. In common with most other pests of stored products, mites appear to be very favourably influenced by high temperatures and humidities such as are found in badly stored grains. Often the quantity of grain spoiled by them is much larger than the one actually destroyed since they transmit several fungal diseases from grain to grain.

Methods of preventing infestation and of eradicating the pest in infested stores have been critically reviewed. The main principles for prevention of mite infestation have been well established. Moisture plays a dominant role in the biology of Tyroglyphids and therefore the provision of a sound dry storage condition is of first importance. Insects, rodents, etc. which spread mites could be excluded as completely as possible. General hygienic measures such as regular removal of dust and debris, isolation and destruction of infested remnant materials should be regularly carried out.

Of the numerous methods of control which have been widely tested, the most effective are heating, drying, fumigation and the application of toxic washes. Drying is probably the most effective method but is often difficult to carry out. Of the numerous fumigants, which have been tried in various parts of the world, chloropicrin, carbon bisulphide, paradichlorobenzene, hydrogen cyanide, ammonia and sulphur have been most widely favoured. The eggs, and particularly the 'hypopi', seem to be specially resistant to many fumigants including HCN. This point seems to have been neglected by several workers. Washing or scrubbing with carbolic and other solutions has been found effective for the disinfection of empty stores. Toxic sprays of dusts cannot be applied to food material and therefore have limited usefulness. Pyrethrum, nicotine, etc. have been found to be ineffective against mites. The use of non-toxic de-hydrating dusts needs more critical experimentation.

In many parts of India conditions are eminently suitable for the rapid multiplication of mites and large quantities of foodstuffs are destroyed or spoiled every year. The role played by mites in the spread of fungal pests in stored food materials is noteworthy. Critical work on control measures which have proved useful in other countries under Indian conditions is called for immediately.—H.S.P.

# From All Quarters

## A FARM IN THE JUNGLE

HERE is a sketch from a private farmer who attempts to show that of all trades and professions agriculture is the best. His experiences given below should prove useful to the general readers and provide an incentive to them for concentrating on farming :

Pandit Ram Dhar Dubey started his farm in the year 1939. He had little or no capital at his disposal and had no agricultural education to speak of. Having practised at the Bar for about 10 years he gave up his profession and fell in with the popular cry of 'Go Back to the Villages'.

The farm known as the Vishnu Agricultural Farm was started in a jungle. The area was a reserve forest of the Central Provinces Government and disforested for cultivation. An area of about 1,100 acres was declared a *raiyatwari* village and divided into several survey numbers of 15 acres each. Thus about 600 acres were made available to *kisans* for cultivation and about 500 acres were reserved for their *Nistar*. In this area Pandit Dubey acquired about 90 acres for his farm.

The farm is situated on the main road, about 12 miles from the nearest station. A canal passes nearby commanding an area of about 20 acres of the farm. The irrigation authorities helped Dubey a lot with their technical survey and measurements and issued canal water for irrigation on his farm Before he started work the Government had organized their model farm in the same forest and he drew his inspiration mainly from this farm.

He approached the farm people and was immediately placed in touch with the officials of the Agriculture Department. They were only too glad to help him and the *Jamadar* of the farm was instructed to guide him in the establishment of his new farm. He started with a capital of about Rs. 200. This amount was invested in collecting jungle wood for building purposes first. Sale of this wood brought him an income of about Rs. 700 which he reinvested in the development of his farm. He cleared an area of 15 acres. In the middle of this area he reserved about half an acre for his farm building, threshing ground and a cattle shed. A long barrack measuring 64 ft. × 16 ft., roofed with thatch was built for his farm building, and there he placed himself, his farm servants and his cattle. The whole area was fenced with *koronda* etc. available in the jungle.

With the help of the Agriculture Department he made a plan and started to work out the same. Two acres were placed under sugarcane and about 10 acres under paddy. The cane seed was supplied by the Department as also the necessary advice and implements. Things went on quite well and the whole experiment appeared thrilling. He left his bungalow in the town and took up his abode on the farm. The outturn for the first year was not encouraging as, unfortunately, much of the crops were damaged by wild beasts of the jungle and his own cattle. The summer months of the year passed off quite all right but staying during the rains was a terrible ordeal. In spite of a mosquito net and the quinine precautions he caught malaria which developed into a chronic form. But he persisted and did not leave the place. He desired to become a denizen of the jungle and get acclimatized to the place. At the end of the year he had his first shock, in that the outturn of the farm was most disappointing. He had deteriorated in health and the whole experiment was going to be a great losing concern. He lost all enthusiasm and began to feel that he had made a mistake and thought that a person desiring to take to agriculture should not risk his life in a jungle but should start in developed areas.

He referred his troubles to the Agriculture Department before leaving the place. They helped him with ideas and great encouragement. They declared his farm a private demonstration farm and a *Jamadar* was deputed to teach him agriculture in the jungles.

The second year he started with fresh vigour. More land was cleared and he placed 5 acres under cane cultivation, about 12 acres under *kondon*, 10 under paddy and 5 under other miscellaneous *kharif* crops. The damage again by wild animals and stray cattle from the neighbouring villages was very heavy but although the outturn was poor, owing to the high prices prevailing, the farm became a *plus* farm. This year he was free from malaria, perhaps he became acclimatized to the place.

Dubey has now begun to feel that, after all, he did not make a mistake in turning to agriculture and has also realized that India has a great future in the fields and a greater one in the jungles, and that the soil of India can open up vast opportunities of personal emancipation to the educated idealists of the country.

'Agriculture', he says, 'is the best, then comes trade, services come third and beggary the last.'

# INDIAN FARMING

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② INDIAN FARMING

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Vol. V DECEMBER, 1944 No. 12

# THE MAINTENANCE OF ANIMAL HEALTH

AN alternative title to this editorial article might be 'The Prevention of Disease in Animals'. During the past century notions regarding this subject have undergone radical changes and it may be interesting and instructive to trace briefly these changes.

One hundred years or so ago there was little precise knowledge of the nature of disease, and disturbed health in human beings and animals was ascribed to such varied and vague influences as 'air-borne miasma', 'noxious effluvia', disorders of the bile or other body fluids. Treatment of disease was regarded as largely the apothecary's art and all manner of weird potions were administered to the unfortunate sufferer. It was rather generally believed that most ailments could be brought under control by drugs or antidotes and that the chief problem was to find the right one. One prevailing idea seemed to be that the more costly or the rarer the remedy, the more sure would be its effect, provided it were given at the right time of the day or night or say when the moon was in its proper phase. Thus it came about that such unfailing remedies as the salts of gold or the blood of snakes were available only to the rich. And one of the endeavours of early chemists was to convert base metals into gold. The apothecary however was not the only person considered to be capable of rendering aid to the sick person. It was recognized, for instance, that if a limb was badly festered or gangrenous, it ought to be amputated and this was done in somewhat heroic fashion by the surgeon. This gentleman was also called in very commonly to bleed the patient, no doubt with the idea that the underlying trouble was a state of congestion which would be relieved thereby or that bleeding would be the means of removing poisonous substances from the body.

Scientific discovery, however, by revealing the truth about disease, largely put an end to such practices as those mentioned. The researches of Pasteur demonstrated that some diseases at least were due to germs and that by the appropriate use of these germs in a killed or otherwise innocuous condition (vaccines) a state of resistance (immunity) could be produced in susceptible animals or men. One outcome of this work was a recognition of the importance of making a correct diagnosis, since the resistance that could be induced was only operative against the species of germ used for promoting that resistance. Pasteur's findings were rapidly extended by other investigators to other diseases, and the use of vaccines (vaccination) against all sorts of ailments became the order of the day. In many cases treatment of this kind is remarkably effective and is not likely to be abandoned. In other cases vaccines have been disappointing or knowledge as to causation of disease has not yet reached the stage where the production of vaccines can be attempted. There is reason to hope, however, that material progress will be made in this field of endeavour, especially by the use of modern chemical knowledge.

A further step in the evolution of events has been the full realization of the fact that in infectious diseases caused by germs of one sort or another, the germ is only one factor and that much importance has to be attached to influences that may affect the susceptible animal. Thus for certain reasons very young animals cannot be readily vaccinated, the degree of immunity produced by vaccination may depend on the bodily condition or state of nutrition of the animals, vaccination may be more effective at one season than at another, in some cases vaccinated animals should be kept at rest for a week or two after treatment. Finally, it is realized that in

general too much should not be expected of vaccines. It is advisable or necessary to prevent vaccinated animals coming into contact with too large a dose of the germs against which vaccination has been performed. Thus in a human population facing an outbreak of smallpox it would be necessary not only to vaccinate all persons at risk but also to remove to a place of safety, such as a fever hospital, all persons actually suffering from the disease. When vaccinating stock in a notorious blackleg or anthrax area, instructions should be issued as to the proper disposal of the carcases of cattle found dead of the disease, in order to avoid contamination of drinking pools and to prevent dissemination of infection by carrion feeders.

Within recent years there has been a strong tendency to return to chemicals or drugs as a means of restoring the sick to health. The early successes of Ehrlich in finding a drug capable of sterilizing people suffering from syphilis, i.e., capable of killing the causal germs of syphilis without injuring the patient, gave rise to great expectations that the method could be extended to other diseases. These hopes were not destined to early and extensive fulfilment, but investigators did not cease their pursuit in this direction. Recently, through the efforts of chemists, certain drugs have been produced, which are remarkably and even dramatically effective in killing dangerous germs within the bodies of infected animals and so bringing about their recovery. These are complex chemical compounds, known as sulphonamides, of which there are already a great number and others even more effective are continually being devised. Nor is the pursuit ending with the manufacture of drugs of known chemical structure. A few years ago Fleming, an English bacteriologist, discovered that certain moulds were capable of elaborating substances which prevented the growth of some kinds of germs. The particular mould with which he experimented belonged to the genus *Penicillum* and the growth-inhibitory substance was therefore named 'penicillin'. This and still other substances of similar nature, as well as sulphonamide drugs, are now having a wide application in the successful treatment of human and animal diseases which previously caused much sickness and mortality.

This brief review will show that in the evolution of medical treatment there has been something like a complete turn of the wheel, from the days when remedies often of unknown composition were used empirically for diseases of which nothing precise was known, to the present time when drugs mostly of complex though known composition are again being employed with success against diseases of which we know a great deal. The future in so far as bacterial or germ diseases are concerned is likely to be bound up with the search for new and more potent drugs, the improvement of bacterial vaccines, and the recognition of the important part that must be played by everything that is nowadays embraced by the term 'hygiene'.

# THE MONSOON OF 1944

(India Meteorological Department)

THE monsoon started approximately in time but it was generally weak in June. In early July both branches of the monsoon strengthened and during this month as well as in August gave generally good rain, even in excess, in some places. The monsoon weakened in September. There were no longish breaks in the monsson.

A notable feature this year was the unusually heavy rain from the middle of July to the middle of August in Sind, Gujarat, west Rajputana and west Central India, which caused loss of crops and property due to floods in the Indus, the Tapti, the Narbada and the Sabarmati rivers.

## *Progress of the monsoon*

*June.*—A feeble advance of the south-west monsoon which occurred towards the end of May caused widespread rain in Malabar, the south Konkan and Mysore, and also in Assam and the adjoining districts of Bengal on the first four days of June. Thereafter the monsoon weakened and withdrew ; but widespread thundershowers occurred in the tract of country from the Punjab and east Rajputana to Bihar and Orissa in association with low pressure areas in northern India. The Arabian Sea branch of the monsoon revived by the 8th and extended northward. A depression developed off the Konkan coast on the 13th and moved over Gujarat and Kathiawar causing widespread and heavy rain there between the 13th and 17th. The monsoon further extended into east Rajputana and Central India on the 17th and to the United Provinces and Bihar on the 18th and 19th. The Bay branch of the monsoon also strengthened and gave rise to a depression on the 14th which moved inland causing widespread rain in Assam and east Bengal between the 15th and 20th. During the rest of the month both branches of the monsoon remained weak although fairly widespread thundershowers occurred in the east of the Peninsula and local showers in the central parts of the country. Widespread rain fell in the belt of country from the Punjab to Assam between the 25th and 28th in association with western disturbances and a low pressure wave from the east.

The monsoon was less active than usual during the month and the rainfall, when averaged over the plains of India, was 23 per cent in defect.

*July.*—Both the branches of monsoon strengthened at the beginning of July and remained fairly strong throughout the month. During the first week the Arabian Sea branch gave widespread rain in the Peninsula and particularly heavy falls in the Konkan, and caused an extension of rainfall into the central parts of the country and the Punjab. The Bay current extended up the Gangetic plain and caused widespread rain over the greater part of the country. A shallow depression over Kathiawar caused locally heavy rain in Gujarat and Sind during the second week.

The rainfall during the rest of the month was mainly controlled by two depressions and two cyclonic storms from the northern part of Bay of Bengal. The first depression travelled from the Orissa coast north-westwards and merged into the seasonal low over north-west India causing widespread and locally heavy rain along its track between the 11th and 17th. The next depression from the head of the Bay caused widespread and locally heavy rain in north-east India, the United Provinces and the central parts of the country between the 18th and 22nd. A cyclonic storm developed in the Bay on the 24th and rapidly passed over Orissa and the central parts of the country as a deep depression and dissipated over Sind on the 28th causing widespread and locally heavy rain in the tract from Orissa and Bihar to Sind. By the end of the month, a second cyclonic storm from the Bay moved from the Orissa coast to the central parts of the country as a deep depression causing widespread and locally heavy falls along its track.

Averaged over the plains of India, rainfall was 25 per cent in excess.

*August.*—The rainfall of the month was mainly determined by two depressions which developed over land and a cyclonic storm from the Bay of Bengal. During the first three days widespread and locally heavy rain fell in the belt of country from the west Central Provinces to Sind in association with the remaining depression of the last month. A wave of low pressure moved inland from the north Bay on the 5th and travelling north-westwards merged into the seasonal low over north-west India on the 10th. It caused widespread and locally heavy rain in the central parts of the country, Gujarat and south Rajputana between the 8th and 13th. A land depression over west Central India moved to the south-west Punjab between the 11th and 15th causing unusually heavy rain in west Central India and the west Central Provinces and widespread rain generally in north-west India with locally heavy rain in Sind and Rajputana. Another land depression appeared over the east Central Provinces on the 15th, moved westwards over the north Bombay Deccan and emerged in the Arabian Sea off Kathiawar and became a cyclonic storm on the 18th. This again caused widespread rain and very heavy falls in the central parts of the country and Gujarat. Due to phenomenally heavy rain in Gujarat, Rajputana, Sind and west Central India, high floods were caused in the Indus, the Tapti, the Narbada and the Sabarmati rivers, causing considerable damage to crops and property. A large number of people were rendered homeless in Sind and south Gujarat, particularly in the Surat and Khandesh districts. Torrential downpours were reported from these areas. Dharampore, in Surat district, recorded 20 in. of rainfall on the 18th. Bhatpur village in the Surat district was reported to have suffered the heaviest damage, the total loss to property and crops being estimated at Rs. 1,55,000. Fourteen houses and 48 huts were destroyed and about 34 were damaged and crops on about 500 acres of land were washed away.

The Bay monsoon was strengthened by a cyclonic storm which crossed the Orissa coast on the 19th and travelled up to the Punjab as a deep depression causing abundant rain along its track between the 19th and 24th. The last depression of the month from the north-east Bay passed over Bengal to the United Provinces causing widespread rain in north-east India and the east United Provinces from the 25th to the end of the month.

Taking the month as a whole, rainfall was in large excess in north-west India outside the east and north Punjab, in west Central India and the west Central Provinces ; particularly heavy falls occurred in Sind, Rajputana, Gujarat and west Central India. Averaged over the plains of India, rainfall was 26 per cent in excess.

*September.*—The monsoon was generally weak during the month. In association with the depression of the last month over the United Provinces and a western disturbance, widespread precipitation occurred in Kashmir, the North-West Frontier Province, the Punjab and the United Provinces during the first four days of the month. Local thunder showers occurred in the south Peninsula on a few days in the first week and between the 10th and 13th. Due to shallow low pressure areas over the south Deccan and Central India, widespread thundershowers occurred in the Deccan and the central parts of the country between the 14th and 19th. A depression which formed over the Central Provinces slightly strengthened the monsoon in the Bay of Bengal and caused widespread rain in north-east India and local thundershowers in the United Provinces and the central parts of the country between the 21st and 24th. A depression from the Bay crossed the Orissa coast on the last day of the month causing local rain in north-east India outside Assam, and a short-lived strengthening of the monsoon in the Bay of Bengal.

The total rainfall of the month was in large defect from Sind and Baluchistan to Central India and the west United Provinces, in Orissa, Chota Nagpur and along the west coast. It was in moderate to large excess in Kashmir, the south-west Punjab and south-east Madras. Elsewhere it did not differ far from the normal.

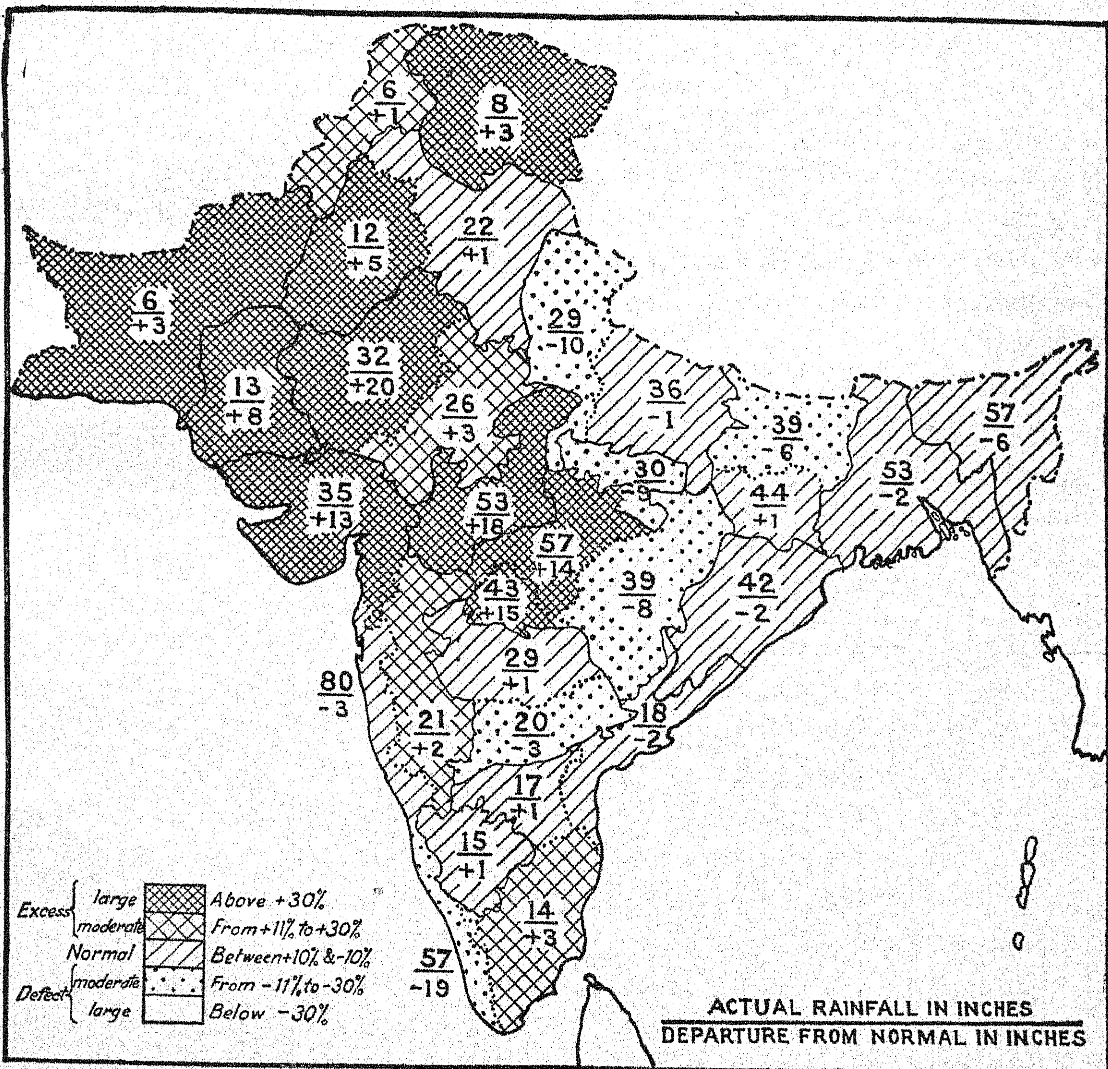
## Summary

Taking the season as a whole, (June to September), rainfall was in large excess in north-west India outside the east and north Punjab, the North-West Frontier Province and east Rajputana, and in west Central India, the west Central Provinces and Berar. It was in moderate excess in the North-West Frontier Province, east Rajputana, the Bombay Deccan and south-east Madras, and in moderate defect in Bihar, the west United Provinces, east Central India, the east Central Provinces, south Hyderabad and Malabar. Elsewhere it

was normal. Averaged over the plains of India, the rainfall for the whole season was in excess by 8 per cent.

The map shows the actual rainfall in inches and its departure from the normal for the period June to September 1944 in the different sub-divisions of India. The progress of the monsoon day by day is shown on page 546. The table on page 547 sets out the progress of the monssoon week by week in the various sub-divisions.

ACTUAL AND NORMAL RAINFALL, JUNE TO SEPTEMBER 1944

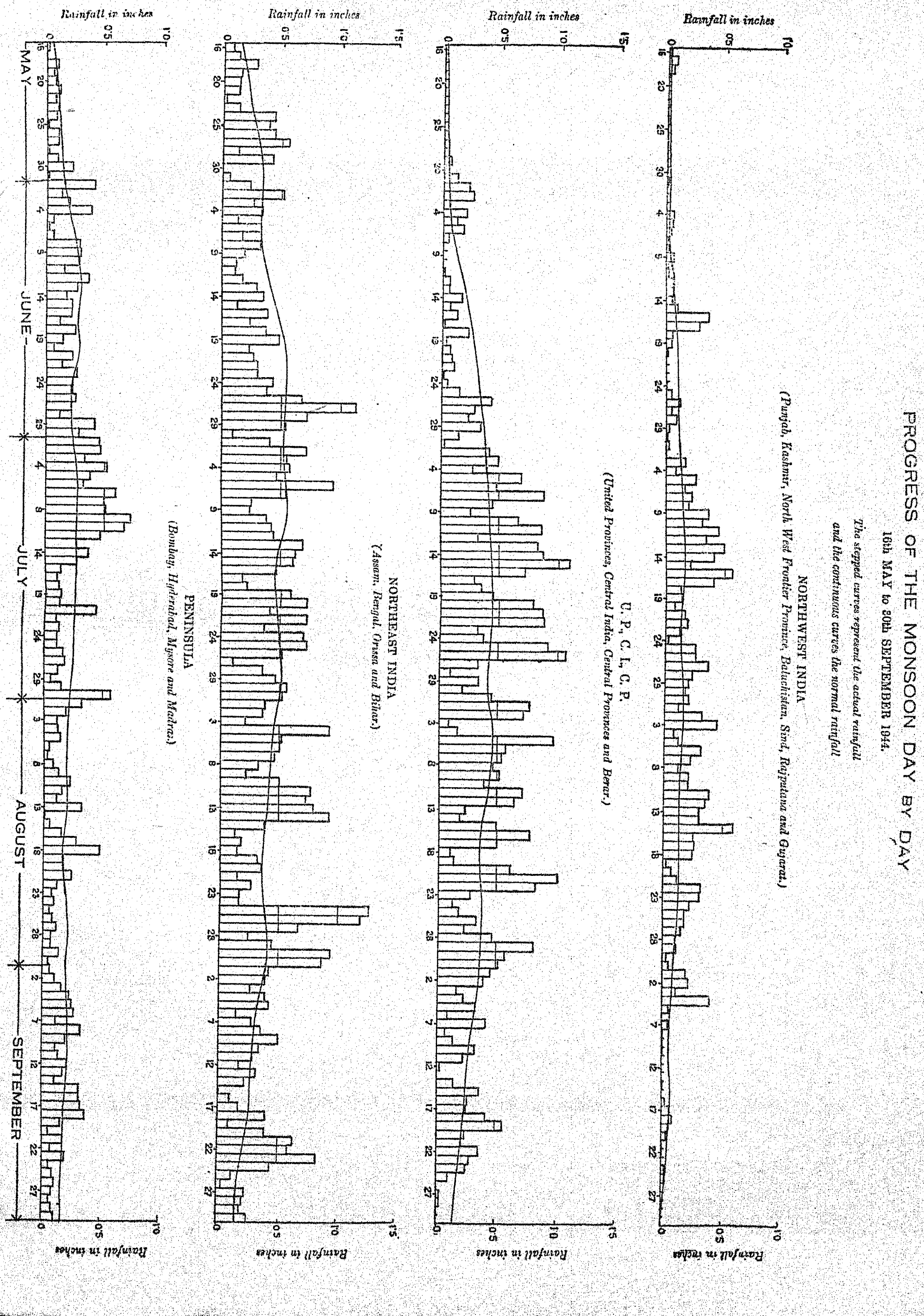


*Progress of the monsoon week by week, 1944*

| DIVISION | Week ending 7-6-44 | 14-6-44 | 21-6-44 | 28-6-44 | 5-7-44 | 12-7-44 | 19-7-44 | 26-7-44 | 2-8-44 | 9-8-44 | 16-8-44 | 23-8-44 | 30-8-44 | 6-9-44 | 13-9-44 | 20-9-44 | 27-9-44 | 4-10-44 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Bay Islands .. | | | | | | | | | | | | | | | | | | |
| 2. Assam .. | 0·7 | 0·8 | **1·3** | 0·9 | 0·9 | 1·0 | 0·9 | 0·9 | 0·6 | 0·5 | 1.1 | 0·5 | 0·9 | 0·8 | **1·9** | 0·8 | **1·6** | *0·4* |
| 3. Bengal .. | 0·6 | 0·6 | 0·7 | 1·1 | 0·9 | 0·8 | 1·3 | 1·1 | 0·5 | 0·8 | 1·2 | *0·4* | **2·2** | 1·1 | 1·0 | 0·5 | 1·1 | **1·6** |
| 4. Orissa .. | **2·0** | 0·5 | *0·1* | 0·7 | *0·2* | **1·6** | 0·6 | **2·0** | **1·7** | 1·5 | 1 3 | 1·4 | 0·9 | 0·5 | *0·1* | 0·5 | 0·6 | **1·9** |
| 5. Chota Nagpur .. | **3·0** | 0·5 | *0* | 0·9 | 1·5 | 0·8 | 1·4 | 1·4 | 1·1 | 1·3 | **1·8** | *0·2* | **3·0** | 0·7 | *0·3* | *0·4* | 0·5 | **3·0** |
| 6. Bihar .. | **2·0** | *0·3* | *0·4* | **1·6** | 0·9 | 0·6 | 0·6 | 0·8 | 0·8 | 1·0 | 1·3 | *0·1* | 1·0 | 1·2 | *0·3* | *0·4* | **2·3** | 0·8 |
| 7. U. P., East .. | **3·3** | *0* | 0·5 | 0·6 | *0·4* | 1·2 | 0·9 | 1·4 | 0·5 | 1·1 | 1·1 | *0·1* | **2·3** | **1·6** | *0·1* | 0·8 | **1·7** | *0·3* |
| 8. U. P., West .. | **8·5** | *0·1* | *0·2* | 0·5 | 1·1 | **1 6** | *0·2* | 1·1 | 0·6 | 0·7 | 0·5 | *0·2* | 0·7 | **1·6** | *0·2* | *0·1* | *0·2* | *0* |
| 9. Punjab E. and N.. | **6·0** | *0·3* | *0·2* | 0·7 | 0·5 | 1·5 | 1·4 | **1·7** | 1·1 | *0·4* | **1·7** | *0 4* | *0·3* | **2·4** | *0* | *0·2* | *0·2* | *0* |
| 10. Punjab, South-west .. | *0* | **2·0** | *0 3* | 1·0 | *0·2* | 1·4 | 1·4 | 1·3 | 1·3 | *0·4* | **7·7** | 1·0 | **4·0** | **4·3** | *0* | 0·5 | *0* | *0* |
| 11. Kashmir .. | 1·3 | **1·7** | 1·0 | **1·7** | *0·3* | 1·0 | 0·6 | 1·0 | *0·3* | **2·7** | **3·0** | 1·0 | *0·3* | **9·0** | *0·2* | 1·3 | **4·0** | — |
| 12. N.-W. F. P. .. | *0* | *0* | *0* | *0* | *0* | *0·3* | *0* | 1·3 | **1·6** | **1·6** | **2·6** | **1·7** | 1·0 | **3·0** | 1·0 | *0* | *0* | *0* |
| 13. Baluchistan .. | *0* | *0* | *0* | 1·0 | *0* | **2·5** | **3·3** | 0·7 | **1·7** | **5·3** | **3·3** | 1·0 | *0* | *0* | *0* | *0* | *0* | *0* |
| 14. Sind .. | *0* | *0* | *0* | *0* | *0* | 1·4 | **3·6** | *0* | **4·3** | **7·8** | **4·2** | *0* | **5·0** | *0* | *0* | *0* | *0* | *0* |
| 15. Rajputana, West | *0* | *0* | 1·0 | *0* | 1·0 | **1·9** | **5·2** | *0·3* | 1·1 | **2·2** | **8·4** | **3·1** | **6·4** | *0* | *0* | *0* | **2·0** | *0* |
| 16. Rajputana, East.. | **3·0** | 0·6 | **2·4** | *0·4* | 0·7 | 0·6 | 1·2 | 1·0 | 0·9 | 1·5 | **2·5** | **2·3** | **1·8** | *0·1* | *0* | 1·3 | *0·3* | *0* |
| 17. Gujarat .. | *0* | 0·8 | **11·0** | *0·1* | 1·1 | **3·0** | **2·9** | 0·8 | **1·9** | **1·7** | **2·2** | **2·7** | 1·1 | *0* | *0·2* | 0·6 | *0* | *0* |
| 18. C. I., West .. | **1·7** | 1·0 | 1·0 | *0* | 1·3 | 0·8 | **3·1** | **2·0** | **2·5** | **1·6** | **2·7** | **3·3** | 0·7 | *0·1* | *0·2* | **1·7** | *0·3* | **2·7** |
| 19. C. I., East .. | — | 1·0 | 0·5 | *0·2* | 1·2 | 1·3 | *0·4* | 1·5 | *0·2* | 1 1 | *0·4* | *0·2* | **1·7** | 0·9 | *0·1* | 0·5 | 0·5 | *0·3* |
| 20. Berar .. | *0·1* | *0 3* | 0·5 | *0·3* | **1·9** | 0·8 | **1·9** | **1·6** | **2·2** | 0·5 | 0·7 | **7·9** | *0·1* | *0·1* | **3·3** | **4·9** | 0·5 | *0·1* |
| 21. C. P., West .. | **2·2** | 0·5 | 0·5 | 1·0 | 1·1 | 1·0 | **2·6** | **2·3** | 1·3 | 1·5 | **1·8** | **2·0** | *0·3* | *0·4* | 0·9 | **2·1** | *0·4* | 1·3 |
| 22. C. P., East .. | 0·9 | *0·2* | *0·1* | 0·7 | 0·5 | **1·6** | 0·7 | 1·4 | 0·9 | *0·4* | 1·2 | 1·4 | *0·3* | *0·4* | 1·0 | 1·1 | 1·4 | 0·6 |
| 23. Konkan .. | *0·2* | 0·7 | 1·3 | *0·4* | **2·1** | **2·9** | 1·0 | *0·4* | **2·4** | *0·2* | *0·3* | **1·9** | 0·7 | *0·1* | *0·1* | *0·2* | 0·5 | *0·3* |
| 24. Bombay Deccan.. | *0·1* | **1·7** | 0·5 | *0·2* | 1·5 | **1·7** | **1·8** | 0·7 | **1·6** | *0·2* | *0 2* | **2·7** | *0·2* | *0·4* | 0·6 | **2·3** | 0·6 | *0·3* |
| 25. Hyderabad, North | *0·1* | 0·9 | *0·1* | 0·5 | **2·1** | **2·3** | 1·3 | 0·5 | 1·4 | 0·5 | *0·4* | **3·5** | *0·1* | *0·1* | **1·9** | **1·6** | *0·3* | *0* |
| 26. Hyderabad, South | 0·9 | 0·7 | *0·2* | **1·6** | **1·9** | **2·7** | *0·1* | *0·3* | 0·7 | *0·4* | 0·5 | 0·7 | *0* | 1·1 | 0·7 | **1·9** | 0·5 | 0·6 |
| 27. Mysore .. | 0·7 | 1·0 | 1·0 | **1·7** | **3·2** | **1·6** | *0·4* | 0·9 | 0·7 | *0·1* | **2·7** | *0·2* | *0·3* | 0·9 | **2·7** | 0·7 | 0·7 | *0·2* |
| 28. Malabar .. | 1·1 | 0·8 | 0·6 | 1·0 | 0·7 | 1·0 | 0·6 | 1·0 | 0·7 | *0·4* | *0·3* | 1·3 | *0·3* | *0·2* | *0·2* | 1·4 | 1·4 | 0·8 |
| 29. Madras, South-east | **3.3** | 1·3 | 1·0 | 1·3 | **3·7** | **2·0** | *0* | *0·3* | *0·2* | 1·1 | **2·1** | *0* | 1·1 | **1·9** | **2·7** | 0·6 | 0·8 | *0·3* |
| 30. Madras Deccan .. | *0* | **2·8** | 0·6 | **3·3** | **7·0** | **3·0** | *0·1* | *0·4* | *0·2* | *0* | 0·7 | *0·1* | *0·1* | 0·9 | 0·5 | **2·7** | *0* | *0·1* |
| 31. Madras Coast, N. | **1·6** | 0·8 | *0* | **1·7** | **2·5** | **1·8** | 0·7 | 0·3 | 0·6 | 0·9 | *0·4* | 1·2 | *0·4* | 1·3 | 0·5 | 0·7 | 0·7 | 0·5 |

The figures in the table represent the ratios of the actual rainfall to the normal rainfall. For example, in the week ending 6-9-44, the figure 1·2 printed against Bihar, means that in that division, the actual rainfall during that week was 1·2 times the normal.

Figures in thick type indicate large excess, i.e. over 50 per cent above the normal, and figures in italics, large defect, i.e. over 50 per cent below the normal.


PROGRESS OF THE MONSOON DAY BY DAY
16th MAY to 20th SEPTEMBER 1944.
The stepped curves represent the actual rainfall
and the continuous curves the normal rainfall
NORTHWEST INDIA
(Punjab, Kashmir, North West Frontier Province, Baluchistan, Sind, Rajputana and Gujarat.)
U. P., C. I., C. P.
(United Provinces, Central India, Central Provinces and Berar.)
NORTHEAST INDIA
(Assam, Bengal, Orissa and Bihar.)
PENINSULA
(Bombay, Hyderabad, Mysore and Madras.)
Rainfall in inches
MAY
JUNE
JULY
AUGUST
SEPTEMBER

# COMB FOUNDATION IN THE PUNJAB

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COMB foundation is defined as 'the base or foundation of honey comb without the superstructure of the cells'[1]. It was first invented by J. Mehring of Frankenthal, Germany, in 1857 and is made from pure beeswax. Being standardized, comb foundation is manufactured by thousands of pounds annually by the large bee supplying firms in Europe and America. When Fletcher and Ghosh started keeping bees at Pusa in 1907-8 they found that the foreign manufactured comb foundation was not suitable for the Indian honey bee, *Apis indica* F. Consequently they had a mill made by A. I. Root Co., Medina, Ohio, U.S.A., according to their own specifications: this mill embossed 24 (as against 19·3 for the Italian honey bee) cells to four linear inches on the comb foundation. Bee-keeping was taken up by the Department of Agriculture, Punjab, in 1934 and from that year to 1939 we used to obtain whatever quantity of comb foundation we required from Pusa, England and America. The Punjab *Apis indica* F. never accepted this comb foundation readily : the cells of Pusa comb foundation were too small, and those of the foreign comb foundation too large for it and in consequence the cells which it built on these foundations were always oblique and irregular and also had inter-cellular spaces in them. Early in our work this was brought to our pointed attention, and investigations[2] were instituted to discover the size of the cell most suitable for the Punjab *Apis indica* F. It was found that the comb foundation with 21 cells to 4 linear inches suited it very well.

Specifications based on these researches were drawn up and supplied to the A. I. Root Co. for the manufacture of a comb foundation mill. This mill, which cost Rs. 750, was received in March 1939. It is with this mill that the comb foundation required by the three Punjab Government Bee-farms at Lyallpur, Nagrota and Katrain, and by the northern India Bee-keepers is now being manufactured. Manufacture of comb foundation involves a number of processes which are described in this article for the information of Indian bee-keepers.

### *Equipment required*

In addition to the mill the following articles are also required for the manufacture of comb foundation : (1) five four-gallon tins and (2) two one-gallon tins, with tops cut off, (3) one four-gallon tin with side cut off, (4) two stoves, *angithis*, or *chulas*, (5) six yards muslin or fine *khaddar* cloth for straining, (6) chisel, (7) hammer, (8) sharp knife, (9) a double walled sheeting tank, (10) two 18 in. × 19 in. plywood or *kail* (*Pinus excelsa* Wall.) sheeting boards, (11) one 16 in. × 24 in. water tank, (12) one 24 in. × 15 in. × 12 in. rectangular tank of galvanized iron sheet, (13) one two inch wide (painting) brush, (14) one 16 in. × 1 in. wooden or plywood board, (15) one comb foundation cutter, (16) tissue paper, (17) packing paper, (18) twine, (19) cardboard boxes of 17 in. × 18 in. × 4 in. and 17 in. × 8 in. × 2 in. sizes, (20) one thermometer.

### *Manufacturing processes*

In the manufacture of comb foundation with a hand-driven machine, four distinct processes are involved namely, (1) refining beeswax, (2) sheeting, (3) milling and (4) cutting and packing. These are described below :

(1) *Refining wax* : Beeswax is derived from honey and brood combs, (the latter having an appreciable number of cocoons in it) and is generally sold in lumps.

For refining, about 10 seers of beeswax and 3 seers of water are put in a four-gallon tin

[1] Root (A.B.C. and X.Y.Z. of Bee culture, 1935, page 159)

[2] For details of these investigations see India Journal of Entomology, Vol. II, 1, pp. 87–91, 1940.

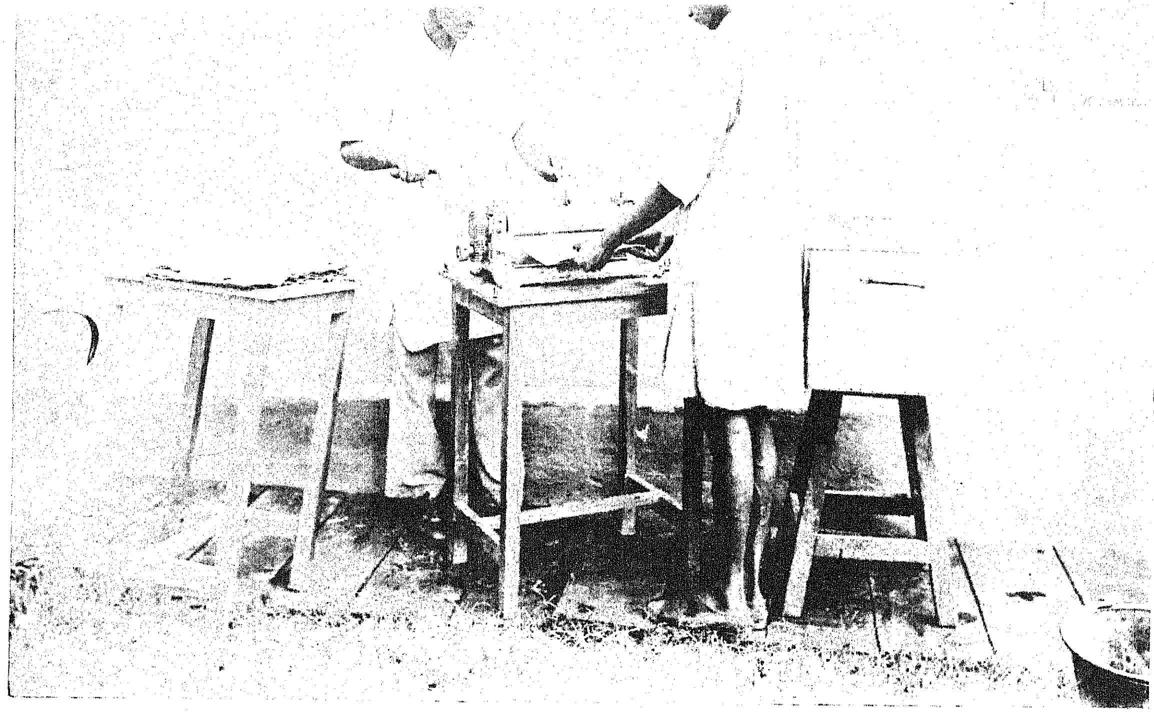

FIG. 1. Milling a comb foundation sheet

FIG. 2. Removing wax sheets from the sheeting board in the cold water tank

and boiled over a stove (or *angithi*) for about half an hour, after which it is strained through muslin or *khaddar* cloth and allowed to settle and cake slowly in the tin. To take out the cake from it the tin is heated gently. After its removal the bottom of the cake is scraped with a sharp knife to remove dirt. Properly refined cakes have light yellow to yellow colour, while overheated cakes are dark in colour. Dark cakes when sliced into thin pieces and placed in the sunlight for three to five days get bleached and improve their colour considerably.

It is a good plan to refine the entire lot of beeswax which is to be converted into comb foundation in one day.

(2) *Sheeting* : Refined beeswax cakes are broken into small pieces with a chisel and hammer and put in a four-gallon tin which is placed in another tin containing water (to avoid application of direct heat to wax since heat darkens it) and put on fire. After the wax has melted, it is strained through muslin cloth into a one-gallon tin, from which it is poured into a previously warmed double-walled sheeting tank. The temperature of the melted wax should range between 65°C. and 70°C. ; otherwise wax sheets prepared from it will crack. The inner tank should have about one in. of water at the bottom to keep down heavier impurities. After the tank is filled with the melted wax to the desired height (which should be maintained throughout the operation by addition of melted wax from the tin from time to time) sheeting should begin. The sheeting board which has been kept soaked in cold water is wiped clean with a sponge or muslin cloth and dipped in the double-walled sheeting tank containing melted beeswax. It is taken out and after dripping of wax has stopped it is immersed again in the melted wax. Generally two dippings are sufficient but if the resultant sheet is not of the desired thickness a third dipping is given. The board with sheets of wax on it, is then immersed in cold water in the 16 in. × 24 in. water tank and the sheets removed from it, cooled and put away. After the removal of the wax sheet the board is allowed to cool in the tank before using it again. If a second board is available then it is used again. The water in the 16 in. × 24 in. tank is continuously renewed to safeguard against cracking of wax.

Two men can prepare about 150 to 200 such sheets in a day of six hours.

After the day's work is done, the dipping tank and the other apparatus should be thoroughly cleaned of wax.

Aging the sheets for about two weeks before milling them is recommended by the manufacturers of the comb foundation mill for subsequent facility in milling.

(3) *Milling* : Two men are required for milling the sheets : one to feed the sheets to the mill and to work it and the other to remove the milled sheets and to 'soap'[1] the rollers. The 'aged' sheets are kept in warm (90° to 95° F.) water in the rectangular tank from which they are fed to the mill and it is always worked clockwise. It would facilitate the removal of milled sheets from the rollers if their thin or upper end is first inserted into the rollers. After insertion, the handle of the machine is turned a little and stopped to enable the other person to separate with his finger nails or a wooden or celluloid comb (but never with a metal piece) the upper end of the sheet from the rollers and to hold it. This done, the first person then moves the handle of the machine at a speed at which the second person can pull the embossed sheet easily, gently and steadily (but not quickly, otherwise the cells may stretch) from between the rollers. Each sheet as it comes out of the mill is examined carefully for proper embossing of cells and if in order it is placed on one side. To get proper embossing and thickness of the sheet only the two screws at the top and the two on the sides of the mill need to be adjusted.

When the day's work is done the machine is thoroughly washed with hot water and the rejected sheets, their broken pieces and other odd bits of beeswax are collected and put into a tin.

The mill is regularly oiled and greased to keep it in proper working condition.

(4) *Cutting and packing* : In our experience every sheet does not come out of the mill regularly and with perpendicular rows of cells. Therefore mass cutting of sheets to the required size is not possible. For this purpose each sheet is placed on a table and on it is placed the 16 in. × 8 in. board in such a way that its 16 in. edge lies along a row of embossed cells in the comb foundation. The protruding portion of the foundation is then trimmed with the comb foundation cutter. The cut sheets are placed one above the other with tissue paper sheets in between them to avoid their adhering

[1] Use of rosin-free textile soap is recommended.

to each other. The trimmed edges are collected, washed in water and remelted for sheeting. After the requisite number of sheets are cut for a 6 lb. carton of 17 in. × 18 in. × 4 in. size they are wrapped in packing paper and packed in the carton, which is then tied with twine.

### *Cost of production*

Comb foundation was produced in the Punjab for the first time in 1940. During this year 193 lb. and during 1941, 1942 and 1943, 443½, 315 and 494 lb. respectively of comb foundation were produced. Thus during 1940-1943 we have manufactured 1445½ lb. of comb foundation. Regular accounts of the cost of producing comb foundation are kept and we tabulate below the cost of producing 443½ lb. and 1 lb. of comb foundation as well as per cent cost of each item, and of the whole cost during the year 1941 :

| | Cost of producing | | Per cent cost of each item to the whole cost |
|---|---|---|---|
| | 443½ lb. C.F. | 1 lb. C.F. | |
| | Rs. as. p. | Rs. as. p. | |
| 1. Depreciation and interest on investment of Rs. 785-4 for milling machine, melting tank, 2 water tanks, 6 four-and 2 one-gallon tins, 2 sheeting boards and one thermometer | 147-1-4 | 0-5-4 | 16·87 |
| 2. Beeswax | 379-14-2 | 0-13-8 | 43·21 |
| 3. Recurring expenditure (10 md. charcoal, 28 gallons kerosene oil, 10 yards muslin cloth, 8 yards voil cloth, 4 cakes sunlight soap) | 54-8-0 | 0-1-11½ | 6·19 |
| 4. Packing (69, 17 in. × 8 in. × 4 in. and 15, 17 in. × 8 in. × 2 in. cardboard boxes, 30 seers *raddi* (waste paper), tissue paper and twine | 95-13-7½ | 0-3-5½ | 10·94 |
| 5. Labour | 120-0-0 | 0-4-4 | 13·70 |
| 6. Overhead charges (at 10 per cent of all the abovementioned charges) | 79-11-9 | 0-2-10½ | 9·09 |
| | 877-0-10½ | 1-15-7½ | 100·0 |

Thus the cost of producing 1 lb. of comb foundation comes to Rs. 1-15-7½ or say Rs. 2. The Department of Agriculture sells comb foundation at Rs. 2-3[1] per lb. of seven sheets for standard Langstroth frames, the margin of as. 3 being a safety valve against a sudden rise of the beeswax which is so much in demand these days.

[1] Owing to exceptional rise in the price of beeswax to Rs. 4 per seer during 1943, the rate per lb. of comb foundation has been raised to Rs. 3-8 per lb. with effect from 1 December, 1943.

# POTATO IN ASSAM

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POTATO is said to have been introduced in Assam during the eighteenth century and since then its cultivation has been on the increase both in the hills and the plains. The area under potato in Assam is now more than 30,000 acres, the most extensive areas being in the Khasi and Jaintia Hills, as well as in the districts of Sylhet, Cachar, Kamrup and Goalpara. It is not only widely grown as a leading vegetable crop in the fields but is also extensively cultivated in the vegetable gardens as the crop fits in admirably with gardening practices. Potato is regularly consumed as a vegetable and is an invaluable article of diet in almost every household.

## *Planting and harvesting seasons*

In the Khasi Hills two crops of potato are grown in a year at altitudes of 4,000 to 6,000 feet. The main crop which is extensively cultivated is planted in February–March and harvested in June–August, depending on the varieties and the time of planting. The second crop is grown in October and harvested by December. The produce of second crop is mainly used as seed for the main crop. Both the crops are purely rainfed and not irrigated.

In the plains potato is grown as a *rabi* crop mainly under irrigation and is planted in October–November and harvested in January –March.

## *Climate and soils*

Potato is a cold loving plant and requires a reasonable supply of moisture for its growth and development. In the plains it is generally grown on river banks and silt deposited areas where the soil is deep, free-working, sandy loam, retentive of moisture and well-supplied with organic matter. In the hills, however, the soil is generally shallow and gravelly loam. Such soils are well-drained and considered to be best for potato. The cultivation of this crop is, therefore, confined to regions, where the mean temperature during the growing season is relatively low, and normal rainfall is sufficient to ensure proper growth of plants as in the hills. Otherwise there should be irrigation and the soil should be retentive of moisture as in the plains. Soils that are compact, water-logged and heavy clay are unsuitable for potato. The old alluvial soil representing tea land soil and the clayey rice lands are also unsuitable for potato.

## *Cultivation systems*

The local method in the hills where *jhuming* is generally practised consists in clearing the land of scrub jungles as the first step. The land is then hoed with *kudali*, clods of earth broken and raised beds are made in the fields. The length of the beds is usually 8 to 12 ft. and the breadth 4 to 5 ft. The furrows made in between the rows are generally 4 to 6 in. deep and 1 to 2 ft. in breadth. A catch drain is usually opened along the contour in the field. When heavy rains occur, the soil from the field is washed down by the water moving rapidly down the slope and the contour drains filled up with silt, which is generally returned to the field. This system of planting potato on raised beds is due to the steep nature of the land and a high rainfall as otherwise the land becomes water-logged and heavy soil erosion occurs.

On the top of the beds scrub jungles are laid and burnt when dry and the resultant ash forked in. Before the tubers are planted the soil on the beds are thoroughly prepared by repeated hoeings in order to get a fine tilth. A small quantity of cowdung manure is also applied on the beds and incorporated into the soil. Whole tubers varying from ½ to 1½ oz. in weight are dibbled into the beds about 2 to 3 in. deep and 9 to 12 in. apart in both ways. Thus each bed accommodates three to four lines of potato crop. The seed-rate per acre varies from 1,000 to 1,500 lb. The inter-cultivation consists in giving two hoeing and earthings, the first when the plants are 6 in. high and the second just before the growing plants have covered the ground.

The crop matures in four or five months and is harvested after the haulms have completely died down. Harvesting in done with a *kudali* or small fork which is inserted at the base of the ridge immediately under the tubers and

lifted so as to bring potatoes to the surface of the ground. The yield of potato varies largely according to the climate, soil, manure and incidence of pests and diseases but the average yield per acre is about 6,000 lb. of tubers.

In the plains potato is grown on the same land year after year in rotation with *aus* paddy or jute. The land is thoroughly prepared by giving a number of ploughings and harrowings and the soil reduced to a fine tilth. Well-rotted cowdung at the rate of 150 to 200 md. per acre is applied a month or so before planting and thoroughly incorporated into the soil. Seed potatoes used are generally small and are planted at a spacing of 6 to 9 in. on ridges 2 to 2½ ft. apart. In the irrigated areas ridges are made 4 to 6 in. high and tubers are dibbled into the top of the ridges about 3 to 4 in. deep and then covered with the soil. In the non-irrigated areas furrows about 4 in. deep are made across the field at distances of 2 ft. and tubers are placed inside the furrows 6 to 7 in. apart and covered with soil to the field level.

The inter-culture consists of frequent and thorough hoeings to loosen the soil and keep the land free from weeds. When the plants are about 6 in. high, first earthing-up is given. This is done by drawing the soil towards the plants from both sides of the rows so that ridges are formed. The second or final earthing-up is done to a height of 5 to 6 in. when the plants have covered the ground.

Irrigation is resorted when the crop suffers from drought, and two or more irrigations are given by running water along the furrows which are formed after earthing-up of the rows. Care is taken that water may not pass over the tops of the ridges. Cultivation after each irrigation is given to restore the mulch and structure of the soil also to conserve moisture.

The crop is ready for harvesting four or five months after planting and this is done only after the haulms have completely died and when the skin of tubers is firm and will not rub off freely. Harvesting in the plains is done with country plough which is inserted at the base of the ridge underneath the tubers and drawn by men or bullocks ; the plough opens the ridge and brings the potatoes to the surface. In the hills harvesting is done entirely by hand digging with hand-hoe. Harvested potato is spread out on the ground in shallow layers in large sheds or other convenient covers for a day or two until quite dry, when they are sorted into seed and table potatoes and then placed in a store.

### *Insect pests*

A number of insects attack the potato crop grown in the plains, of which the cutworms ( *Agrotis ypsilon* ) is the most common and serious pest in Assam. This insect injures the young plants by cutting the stems on the surface of the ground. The adult female deposits eggs in late summer which hatch in a few days. Young worms (grub-like caterpillars) hibernate under the soil and come out in the spring and feed voraciously on potato plants. This pest is controlled by adopting the following measures: (1) A deep ploughing of potato soil about 12 in. deep in winter thus exposing the grubs which are eaten by birds ; (2) A bait prepared with a mixture of 50 lb. bran, 1 lb. Paris green and 2 lb. molasses. One table spoonful of this mixture is put near the potato plants at distances 10 to 12 ft. The insect eats this and dies.

Red ant (*Dorylus orientalis*) : The red ant is a severe underground pest of potato both in its early as well as late stages of growth. Its incidence is usually very high in old alluvial soils though much less in the riparian tracts. When this pest attacks a potato crop it causes enormous loss of tubers.

When infestation by this pest is visible in certain plants, the affected ones should be dug out and destroyed and the unaffected ones should be watered with a solution of crude-oil emulsion (1:600) in rings made in the soil around the plants or with a solution of phenyle (1:250) at bi-weekly intervals.

If a plot can be wholly irrigated, occasionally charging the water with (1:1, 250) crude-oil emulsion or (1:640) phenyle, the incidence from red ants can be avoided to a great extent.

Potato moth *Phthorimaea operculella:* This pest has not so far caused very serious damage to potato in the field but sometimes becomes serious on stored potato in the plains. In the field the damage can be prevented by deep earthing so as not to expose the tubers for the laying of eggs by moths. In the store, the moths may be killed by light traps to which they are attracted[1].

### *Diseases*

Potato is subject to a large variety of diseases which reduce the productivity of the crop and the keeping quality of the tubers. The disease which is responsible for the greatest injury to

[1] As recommended by Munro, (1937) *vide* Leaflet No. 18 (Revised), Department of Agriculture, Madras.

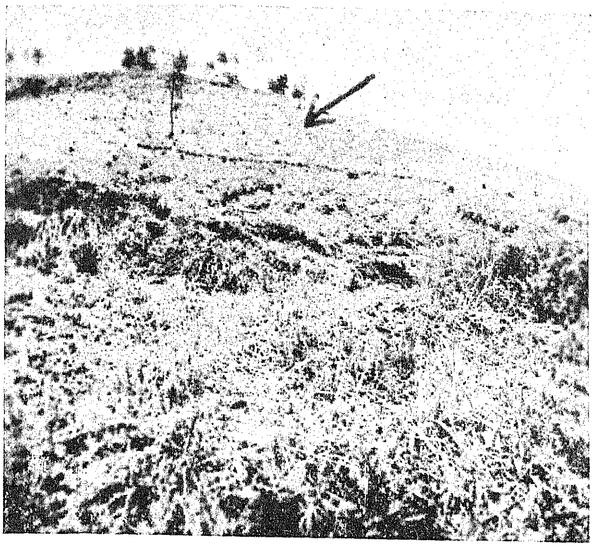

Fig. 1. Arrow points *jhum* land in the Khasi hills cleared of scrub growths for potato cultivation

Fig. 2. Arrow points potato grown on the top of th hills by local method

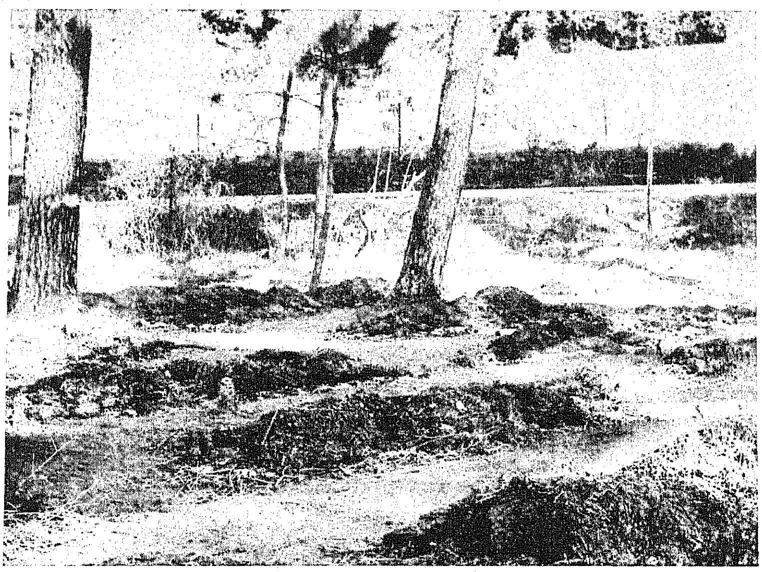

Fig. 3. Manuring beds where potato tubers are planted

the crop is late blight (*Phytophthora infestans*). It is most common in the Khasi Hills and assumes serious proportions in some years.

The symptoms of this disease develop first on lower leaves as water-soaked spots and later as somewhat darkened patches. On the lower surface of the leaves a delicate white mould can be seen. If the weather remains showery and humid these areas extend rapidly, the tops are reduced to a rotting mass and the tubers become infected. Such affected tubers in wet soil or in unfavourable storage condition are invaded by other saprophytic fungi and bacteria which reduce the tubers to a putrid mass.

The disease is controlled by spraying with Bordeaux mixture (5:5:50), when the plants are 6 to 8 in. high and the spraying repeated 2 or 3 times at intervals of two weeks.

Early blight (*Alternaria solani*) : This disease is more common in the plains and causes considerable damage in some years. Symptoms occur on the leaves in the form of dry brown spots which develop into concentric rings. Later on the leaves dry up and the plants wither prematurely as a consequence of which the yield of tubers is reduced. The disease may be controlled by spraying with Bordeaux mixture as recommended for late blight.

Scab (*Actinomyces scabis*) : This disease is met with throughout the province and the damage is serious in a few instances. The disease appears as minute brown spots on the surface of the tuber and then develops into hardened, circular and corky areas and may either affect only a small part or the whole of the tuber. Scab is seed-borne and the disease may be controlled by treating seed potato in a solution of formaldehyde (1 lb. to 30 gal. of water) for about two hours. But this treatment is not sufficient to prevent infection of potato tubers if the soil has already been infected. In that case it is necessary to practice rotation to remove the disease from the soil where it has once gained a foothold.

Ring disease (*Bacillus solanacearum* : This is very common and causes heavy loss of tubers in storage during June-August in the plains as a result of which it becomes impossible to preserve seed potato. The symptoms of the disease are easily recognized in the field by the haulms suddenly dying when in active growth and on cutting the tuber a brown ring near to and running parallel to the skin is also noticed. The organism dissolves the cell-walls of the tubers and sets up putrefactive changes and if affected tubers are pressed by hand a watery matter exudes from them. Diseased plants and tubers should be immediately dug out and burnt to prevent the spread of the disease. As a preventive measure special care should be taken to get rid of excess of moisture and water-logged condition of the field. In case where the soil is already infected a rotation which avoids growing potato for a period of two to three years is necessary to prevent the disease.

### *Varieties*

Potatoes grown in Assam are popularly known as Shillong potato and local potato. Shillong potatoes are those which are imported from England and introduced after trial at the Government Farm at Upper Shillong. The most important varieties now under cultivation are, viz. (1) Epicure, (2) Kerr's pink, (3) Up-to-date, (4) Arran consul, (5) Arran banner, (6) Great Scot, (7) Invernes favourite, (8) Talisman, (9) Windsor Castle, (10) *Magnum Bonum*, etc. These varieties possess good qualities, viz. large and smooth tubers, high yield, good shape, white flesh, good cooking quality and flavour.

The local potato which is grown in the plains belongs to varieties the tubers of which are small, hardy and soapy and look almost like the original wild potato. Great confusion exists as regards the names of different local varieties as the same variety is often designated by different names in different localities.

### *Potato improvement work*

The work on the improvement of potato in Assam was started at the Upper Shillong Farm situated at an altitude of 6,000 ft. from the year 1909 and is still continuing. This work mainly consisted of acclimatization of and trials with improved varieties obtained from Europe and manurial experiments. More than 50 improved varieties have been tested so far, of which a dozen varieties have been selected for high yield and other qualities, and introduced in the different parts of the province. Experiments have proved that the best chemical fertilizer is a mixture of niciphos at 200 lb. and sulphate of potash at 200 lb. per acre (in addition to a basal dressing of 100 to 150 md. of farmyard manure) with the application of which the improved varieties can yield about 200 md. per acre under the Upper Shillong Farm conditions. But the average yield of potato of the improved varieties both in the hills and plains is from 60 to 90 md. per acre.

The main factor responsible for this extraordinarily low yield is the prevalence of diseases, mainly blight, which reduces the yield by about 50 per cent in some years.

Although it has been demonstrated that spraying with Bordeaux mixture can save the crop from the ravages of diseases, yet this method of curative treatment has not been adopted by a single cultivator in Assam. The so-called random selected resistant varieties have also not been able to hold their sway against the diseases to which they ultimately succumbed. It was, therefore, obvious that production of disease resistant varieties combining high yield and good qualities by scientific breeding is the only solution of the problem.

### *Future line of work*

Thanks to the foresight of the Imperial Council of Agricultural Research, New Delhi, a Central Potato Breeding Station was established at Simla in 1936, with the object of evolving new varieties of potato which would combine high yield with disease resistance and be adaptable to Indian conditions. India had so long been dependent for her potato varieties on Europe. European varieties had been evolved to suit entirely different soil, climatic and biotic conditions. With the help of plant breeding Institutes in the U.S.S.R., Germany and England, a very valuable collection of the important central and south American species of both wild and cultivated potato (*Solanum*) were made at the Simla Station and these are being utilized for cross-breeding work. The systematic scientific breeding work initiated with these materials by the Imperial Economic Botanist has already resulted in the production of some improved varieties combining high yield, good quality and disease resistance.

The Department of Agriculture, Assam, is on the move to supplement the Simla line of work for the production of high yielding potato varieties with good keeping quality, resistance to diseases and adaptability to the climatic and soil conditions of the province. This work will be done at the Upper Shillong Farm, where some preliminary work with a number of Simla varieties is already in progress.

## PEELING POTATOES WITH A CHEMICAL

PEELING of fruit and vegetables in large quantities has long been made easier by a process of immersion in caustic soda. For example, peaches are skinned by this method before canning. During the war the technique has been employed on an even larger scale than before and, according to a paper by A. H. Copeland, R. M. Chatters and R. D. Kerwin presented to the American Chemical Society, the widespread use of soda lye for this purpose has led to the discovery of new drugs, plastic ingredients and valuable oils from the peels and seeds that were formerly wasted. The world's largest potato-processing plant, situated in Caldwell, Idaho, can peel 450,000 lb. of raw potatoes in a day, the tubers being conveyed through a 20 per cent caustic soda solution which is kept at a temperature just below boiling. Three minutes treatment is sufficient to loosen the skins, eyes and surface blemishes, and the potatoes are then conveyed mechanically through a rotating cold-water washer in which they are freed of skins and all caustic soda by means of high-pressure water sprays.– *Discovery*, October 1944

# RESEEDING IN BARANI GRASS LAND

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THE Government Cattle Farm, Hissar, covers an area of 40,000 acres but only about 5,000 acres of land is canal-irrigated. The rest carries a variety of natural grasses which grow entirely under *barani*[1] conditions. In normal years of rainfall, excellent grazing is available for livestock all the year round and in addition, several stacks of hay are made to build up a very substantial fodder reserve.

Unfortunately, from the year 1937-38 to 1941-42, continuous and unprecedented drought conditions prevailed. The average rainfall during these years was considerably below normal and was badly distributed. When this cycle of very lean years did come to an end in 1942-43, it was discovered that very extensive bare patches, devoid of all vegetation, had appeared all over the grazing area. Roughly speaking, a total area of about 10,000 acres had completely caked up and it was apparent that unless suitable steps were taken, it was likely to remain entirely unproductive.

## *Recovery of bare patches*

The following experiments were undertaken in an endeavour to discover a suitable technique for restoring plant cover on the bare and caked up patches:

1. Three areas, typically rendered bare, were selected in different parts of the grazing area and *kiari bandi*[2] was carried out in them. The size of *kiaris* varied from one-fourth of an acre to two or three acres. It was hoped that the *kiaris* would retain the rain water and thus offer more favourable conditions for the germination of grass seed brought in by wind. In spite of excellent rains in 1942-43, the *kiari bandi* plots were no better than the control plots maintained without *kiari bandi*, side by side with the experimental plots.

2. Twelve five acre plots were selected in the centre of bare patches situated in different parts of the grazing area. Each of these five acre plots was ploughed up with a country plough and the ploughed up area was enclosed by a *wat*[3] one foot high. The central one acre area in these plots was then sown, during the rains, with *anjan* (*Pennisetum cenchroides*) and *palwa* (*Andropogan pertusus*) grass seeds, the commonest types found in the grazing area. These one acre plots were then enclosed by thorn fencing to damage by cattle prevent and were also *bunded*.

There were excellent rains in 1942-43. The *palwa* seed did not germinate but *anjan* did very well. There was a luxuriant growth of this grass and other weeds not only in the central one acre but also in the surrounding four acres. This was in distinct contrast with the bare land all around the five acre plot.

3. An area of 28 acres with very indifferent grass cover was divided up into 28 one acre plots, each measuring 92 ft. × 462 ft. All except the control plots were cultivated with a country plough, spring-toothed harrow and cultivator separately. The cultivator was drawn behind a Fordson tractor.

The four treatments mentioned above were each replicated seven times and were arranged in two blocks of 14 plots each.

## *Best growth of grasses*

During the summer rains of 1941, various grasses and weeds appeared in these plots. The growth and the number of plants were studied in them. It was found that the best growth was to be seen in the plots cultivated with the country plough.

In 1942-43, the growth of grasses in the plots where country plough had been used were again the best.

The following statement shows the out-turn from the differently treated plots when harvested in January 1943.

[1] *Barani* — Depending entirely on rainfall.

[2] *Kiari bandi* — Division of land into small plots by ridges of earth.

[3] *Wat* — A ridge made by a furrow turning plough.

*A statement showing comparative out-turn of the different cultural plots during the year 1942-43.*

| | Country plough | | Control plots | | Harrow | | Cultivator | |
|---|---|---|---|---|---|---|---|---|
| | grass hay | dry weeds | grass hay | dry weeds | grass hay | dry weeds | grass hay | dry weeds |
| | 123–26 | 5–37 | 47–14 | 9–11 | 63–39 | 11–14 | 72–35 | 26–2 |
| | md. | | md. | | md. | | md. | |
| Total in 7 acres | 129–23 | | 56–25 | | 75–13 | | 98–37 | |

Country ploughed plots produced the highest quantities of hay and decreased the natural weeds also.

Experience gained as a result of the above noted observations was put into practice immediately. Bare patches covering an area of 200 acres were ploughed up and enclosed by small *bunds*. Another 770 acres of land which had caked up was let out to tenants for cultivation on *batai*.[1] Sowing by tenants was carried out by means of drills, thus leaving open furrows. As a result of these operations, there is now a much better plant cover in this area and incidentally a handsome quality of grain and fodder has come in, as the Farm *batai* share, to swell the fodder reserve.

[1] *Batai* — Letting out land to the tenants and dividing the produce at fixed rates between the tenant and the owner.

### Conclusions

From the observations recorded above, the following conclusions may be drawn :

(i) *Kiari bandi* in itself does not offer a solution for the reclamation of bare patches in *barani* grass land at Hissar.

(ii) Bare patches in the *barani* grazing area can be made to grow grass again if they are ploughed up and reseeded, naturally or artificially.

(iii) Cultivation by harrow and tractor cultivator improves the land for grass production but better results are obtained by deeper cultivation, such as is achieved by the use of a country plough or a furrow-turning plough.

(iv) The method employed is very cheap and within the means of an ordinary cultivator. The expenditure at pre-war rates would be:

| | |
|---|---|
| Ploughing charges for 5 acres | Rs. 10 |
| Fencing of central 1 acre | ,, 15 |
| Total | Rs. 25 |

Bunding or ridging is done by a furrow-turning plough at the turn of ploughing.

# AMERICAN COTTON GROWING IN SIND

ROGER THOMAS, C.I.E., J.P.
*Sind Land Development Ltd., Mirpurkhas*

MANY sporadic attempts have been made to grow long staple cotton in Sind. Egyptian seed has been tried at intervals by various administrative officials during the past 80 years. Prior to the construction of the perennial Jamrao Canal in 1900 cotton could be sown each year only after the arrival of inundation flood water, and generally not before June. This made it too late for Egyptian types to develop fully before the winter when the cold stops all growth and the leaves are shed. The plants were then allowed to ratoon, and it is a matter of interest that they customarily gave best yields in the second year of growth though a good crop could generally be picked in the third year also. In about 1907-15 Mr G. S. Henderson, then Deputy Director of Agriculture stationed at Mirpurkhas who had previous experience in Egypt experimented with various Egyptian types of cotton on the Jamrao Canal. The success that attended this effort exceeded that of any earlier or later attempts, and altogether a few thousand bales of Sind-Egyptian cotton were marketed. From 1915 this work was neglected, and by 1931, when the Lloyd (Sukkur) Barrage was completed, there were no Egyptian cotton types grown in Sind except for small scale experiments with newly imported Egyptian and Sea Island seed at the new Sakrand Agricultural Station. These experiments gave an indication that under optimum conditions of soil and cultural practice, and in favourable seasons, both Egyptian and Sea-Island types would grow well and give a moderately good yield. The trials were not sufficiently exhaustive to justify extensive cultivation, but quite a number of zemindars grew relatively small areas. The seed was broadcast as customary in Sind without regard to the delicate technique observed throughout Egypt. The results were often disappointing. The seed soon got mixed with American and *desi* types. In consequence both the growers and the trade lost interest. This was in the early thirties.

## *Selection of types*

The Punjab-American F (Foreign) types have provided the foundation stock for all cotton improvement work with Upland cottons in Sind. The parent stocks have been 289F, 285F and 4F,—all selections made by Mr D. Milne at Lyallpur from the Dharwar American grown in the Punjab area during 1910-20. When the lately retired Director of Agriculture in Sind, Rao Bahadur K. I. Thadani was Botanist at Sakrand he wisely concentrated his cotton breeding work on types having a superior staple. The selection from Punjab 289F, now known to the trade as Sind Sudhar, succeeded in establishing itself on a wide area on the left bank of the Indus with the advent of Lloyd Barrage, and it finds a ready demand from Indian Mills. It spins maximum warp counts of about 40's. His 4F-98, a shorter staple variety, has become established on the right bank of the Indus.

During the early years of the Barrage, designed to irrigate about 7 million acres, the seed of Sind Sudhar was in such short supply that many of the more enterprising growers regularly imported other pure varieties of seed in bulk from the Punjab for sowing. Others, who had facilities for maintaining the purity of their types in field and factory, propagated their own supply after initially importing stocks from the Punjab. The main types imported into Sind were K.T. 25 and K.T. 23 (selections from 289F made by the writer at Khanewal), N.T. (various New Types bred by Mr T. Trought at Lyallpur in experimental plots but never available in large quantities and LSS (*Labh Singh Selection*). The staple length and spinning qualities (of all these Punjab importations, other than LSS, were much alike and on a par with Sind Sudhar. Latterly the new American variety M4 (Mirpurkhas) has been in great demand from growers and threatens to replace all other American types on the left bank. It also shows promise on the right bank. The trade name 'Sind N.T.' is the name originally given by the Department of Agriculture to all Sind-American cotton which was not grown from Departmental Sind-Sudhar seed. The trade adopted the name to designate the Sind-American crop in general and market quotations are now customarily made on this basis.

In Sind the prevailing climatic conditions

vary within relatively short distances. The same feature applies to the cotton growing areas of the Punjab. Some cotton varieties are peculiar in that they react differentially to relatively small changes in climate and cannot be acclimatized except through selective breeding. Sind Sudhar was found to grow well throughout the Barrage zones but on the Indus right bank the departmental selection 4F-98 was found to give better returns to the grower. In the Nawabshah district in mid-Sind the very coarse *desi* type WN-27 has persisted in holding its own but on a progressively diminishing area. In the southernmost tract on the left bank imported Punjab-American types are largely grown. On the extensive areas favoured by B.C.G.A. in this tract K.25 (formerly K.T. 25) is most favoured; LSS is largely grown on the Denisar Estate. The Sind Land Development Company have until recently found K.T. 23 and later selections from it known as S.L.D. types to be best suited to local conditions. But with the advent of M4 the cultivation of all K.T. and S.L.D. types on the farms of this Company have been discontinued.

### The new M4 variety

The history and characteristics of the new variety M4 are of interest. From information supplied by Mr B. B. Desai, now Deputy Director of Agriculture in Sind, it is gathered that he was Cotton Breeder and Officer in Charge of the Mirpurkhas Seed Farm from 1932 to 1936. He reports that in company with his assistant Mr Daiya, he made a large number of selections from the field crop of KT-23 at S.L.D. Girhore farm in 1933. Altogether 230 single plants were selected and sown in progeny rows at the Mirpurkhas Seed Farm in 1934. The superior selections were further propagated and tested by him during the next two years. He found the selection that was later given the name M-4 to be outstanding in many characteristics. This variety was taken over by Mr B. B. Thakur on his appointment as Cotton Breeder at Mirpurkhas in 1936. In 1939 it was included for the first time in the varietal tests at Bodar Farm (S.L.D.). The writer was so impressed with the desirable characteristics of the plants that all the available seed surplus to the requirements of the Cotton Breeder was planted on the same farm in 1940 with single seeds dibbled by hand at intervals of 6 ft. in both directions on a few acres. The same procedure was adopted in 1941 but with closer spacing. For the 1942 season, the Company had enough seed to meet its own requirements and to supply about 3,600 md. to outsiders including about 1,400 md. sold to the Agricultural Department who distributed this variety for general cultivation for the first time in that year. The seed of M-4 sold for sowing in 1943 by the Company was enough for 1,00,000 acres. The varietal experiments conducted by the Department of Agriculture have proved conclusively its general superiority as a heavy yielder. As the trade has not yet become fully accustomed to this new variety of cotton its characteristics are enumerated below.

### Characteristics

M4 is a Sind-American cotton of 289F type. The plant is short, compact and dome shaped. It bolls freely from the bottom and holds a high percentage of its flowers. On attaining its maximum development the plant, unlike some other American types, abruptly stops flowering. It is early maturing, relatively resistant to *tirak* (bad opening of bolls), relatively resistant to jassid attack, partially evades bollworm attack by virtue of its earliness and therefore has less stain when ginned, its opened bolls are wind-resistant and easy to pick, heavier yielder than any other 289F types in most of the varietal tests so far conducted, adaptable to a wide range of soil and climatic conditions. Seed is of medium size, slightly fuzzy and uniformly greyish-white in colour without admixture of green or black seed. The ginning percentage is higher than Sind Sudhar but lower than K.T.25. The staple averages 0·95 in. and is regular. It spins 36-40's maximum warp counts as determined by the Director of the Indian Central Cotton Committee Technological Laboratory. There is a strong likelihood of this variety becoming the predominant crop in Sind until such time as something more profitable to the grower is found.

### Cotton Breeding Scheme

There is no finality in plant breeding. There is always something better waiting to be discovered or to be created by the application of modern scientific knowledge by the plant breeder. Sind offers great scope in this respect and the Indian Central Cotton Committee as well as the Sind Government are fully allive

to the possibilities. In 1938 they sanctioned a long staple Cotton Breeding Scheme in Sind to evolve varieties of American cotton having staple of $1\frac{1}{16}$ in. or better which it was hoped could successfully compete with the existing American types in Sind and thereby enable India to become less dependent on imported long staple cotton. The work was started in 1940 and is in charge of Dr S. Sankaran who cross-fertilizes the present 'acclimatized' 289F types with long staple imported American types. The progeny is then back-crossed with 289F types to impart a bigger dose of the desirable 'acclimatized' parent without losing staple quality and ginning percentage. Much progress has been made in the relatively short time since this scheme came into operation and from the thousands of cross-fertilized flowers some of the latest progenies show considerable promise as regards yield, vegetative characters, earliness, staple length and ginning percentage. But work of this nature takes time to materialize into a crop on a commercial scale.

### *Maintenance of purity*

The Government of Sind in its desire to maintain the purity of the cotton crop has for some years inaugurated a Seed Distribution Scheme partly financed by the Indian Central Cotton Committee. The Cotton Ginning and Pressing Act which became operative in 1941 makes it penal to gin American Cotton containing more than 10 per cent admixture of *desi* cotton. Some sections of the trade consider this percentage to be too liberal and an undesirable loophole for the unscrupulous ginner. A noticeable feature of the field crop of American cotton in Sind is the frequency of fields containing some *desi* cotton plants varying from about 5 to 10 per cent admixture. This matter is now receiving the close attention of the Sind Government.

A long-stapled Indian variety of Egyptian cotton is being increasingly employed for making a thin and strong fabric for parachutes, used for dropping quantities of food, ammunition and other military supplies.

A revival of the natural silk industry in India has stepped up Indian raw silk production from 300,000 lb. last year to 600,000 lb. this year—*Indian News and Notes.*

# CATTLE BREEDING AND GHOSIS

MUNSHI S. KARIM BAKHSH, A.L.T.
*Lucknow*

INDIA, on account of her natural resources, is a vast agricultural country, and the majority of her inhabitants, have, from times immemorial, been vegetarian and abstainers from animal food. For development and growth of their bodily system, they stand in greater need of using milk and its byproducts than the people of other countries. The production of good milk and breeding of healthy cattle are therefore vital questions. The Government realizes the importance of this question and is trying to improve the type of cattle by establishing cattle-breeding farms at various places under duly qualified and well-paid experts. But all their efforts and intentions do not seem to make any appreciable difference in the supply or quality of milk sold in cities. This is mainly due to the ignorance and poverty of the people engaged in the production and distribution of this article of daily necessity.

### *The pastoral castes and milk trade*

India is a land of castes, and each caste is a sort of trade union, which has been plying its trade from the ancient times. Ghosis, Gaddis, Ahirs, Gwalas, and Gujars are the principal castes who have, from the earliest times, been engaged in this trade, and unless their condition is improved, there can be little hope of a solution to this important problem. These pastoral castes form not an insignificant portion of the rural population in India and combine the important profession of cattle-breeding with agriculture. Before the advent of the British Government when India was split into small principalities and overrun by mercenary adventurers, there was very little agriculture, owing to the insecurity of lives and limbs. Most of the lands remained untilled and unclaimed and were a free pasture ground for animals. These tribes on account of their tribal organization and caste unity could hold their own against the inroads of any roving bands of marauders and the ever-shifting political changes made no impression on their condition. They were free to graze their cattle or found their colonies anywhere they liked and as there was plenty of grass for their animals their general condition was perfectly healthy and the yield of milk quite satisfactory. There was an abundance of milk and ghee in the country and these pastoral castes were more prosperous in those troublous days than they are at present.

### *Migration of Ghosis into cities*

The security of life and prosperity afforded by the British Government have given impetus to agriculture ; and every available piece of ground is being utilized for that purpose. The value of lands is increasing daily and the zemindars cannot spare any lands for pasture grounds. As there are practically no free pasture grounds for their cattle in the country and milk fetches better value in the cities, Ghosis have left their villages and migrated into large towns. They are perhaps one of the most backward communities in India and being too poor to afford good housing accommodation for themselves or their animals, generally live in an unhealthy locality in the town.

### *Ghosis and the Bania money-lenders*

Owing to the lack of capital, they have to borrow money at an exhorbitant rate of interest from a money-lender to buy their cattle and as long as the animals give milk they give him some sort of food, and try to pay up the debt. It usually happens that the animal dries up before they have paid up even half of their debt and in order to keep their trade going they have to solicit the aid of the same *bania* for a fresh loan to enable them to buy another animal. The clever *bania* adds up the unpaid balance to this fresh sum and charges the same, or even a higher rate of interest for the whole amount. The Ghosis are the *bania's* best customers, as they not only pay a good interest for their loans but also buy food and forage from him and sell their milk to him or to his relation, the *halvai*, at a much cheaper rate. Thus the Ghosis, in spite of their hard and strenuous work, cannot afford good food or accommodation for themselves or their animals and live a life of perpetual misery and starvation

while their patrons the *bania* and the *halvai* grow fat and rich. For their sad plight the Ghosis themselves are to blame, for they have not marched with the progress of times and are trying to carry on their profession in the same way as their ancestors used to do in olden times.

### Uplift of the Ghosis

Cattle-breeding being more complicated and less profitable than agriculture, can neither be undertaken by big landowners nor by clever financiers. Ghosis and Gwalas are the only people who have been doing this work for a living and this milk problem can easily be solved by undertaking an upliftment work among them. Any reform to be successful must begin at the bottom, so earnest efforts should be made to educate these pastoral castes and improve their lot. Their utter ignorance and stupidity debar them from understanding the benefit of mutual cooperation. Example is the only thing that is likely to appeal to their slow intellect, and if a few of their intelligent caste-men are made to set an example of how cattle-breeding, milk production and distribution should be conducted on sanitary principles, they can gradually be weened away from towns and induced to live in the country. How can good milk be obtained from half-starved and badly-housed animals, and how can the men whose condition is as bad as that of their animals, be expected to understand the rules of hygiene and sanitation ? A few of them who have received some education and realizing the futility of continuing their ancestral calling under existing circumstances have adopted some other means of livelihood or entered Government service as clerks etc.

### Solution of the milk problem in cities

These men would, if proper inducements are offered, be only too glad to revert back to their hereditary profession, which they have had to give up for lack of capital and means, and I would like to lay the following suggestions for the consideration of the Government and the public to solve the milk problem in Indian cities :

1. Suitable lands within distance of ten or twelve miles of a large town to be given to intelligent Ghosis on lenient terms to undertake cattle breeding and dairy farming under the patronage and direction of officers of the Agricultural Department and allow them to found purely Ghosi colonies.
2. Sufficient funds to be provided to enable them to get cows and buffaloes of a good milking type and to build suitable sheds for their animals. Cooperative banks to lend them a reasonable sum on nominal interest for this purpose. The payment of the debt to be spread over a fixed period and all animals, lands etc. to remain Government property till all debts are paid in full.
3. Agricultural and military dairy farms to lend their best bulls for covering purposes to these Ghosis on a small fee.
4. Ghosi boys, who have read up to the eighth or tenth class of an Anglo-vernacular school, to be admitted free of fees in an agricultural school to learn how to raise fodder crops and make suitable silage for cattle, so that on completion of their course they can work on their relation's farms.
5. These colonies to be made the centres of propaganda among the Ghosis ; how to keep and breed cattle under sanitary conditions and how to handle and distribute milk.
6. A subsidized Urdu monthly magazine to be started to deal with the milk problem in India and useful extracts from cattle breeding and dairy farming journals of England, Ireland, Australia and America, to be translated and published in this magazine, and photos of British and American cattle to be distributed free of any charges among the Ghosis to enable them to compare the condition of their own animals with those of other countries.
7. Annual cattle shows to be held in one of these colonies open to animals of pastoral castes only and good breeders to be rewarded with certificates and prizes.
8. Municipalities to build suitable milk shops in different parts of the town and let them out to these Ghosis on nominal rent, so that milk can be brought in sealed cans from one of these colonies and sold at these milk depots under the supervision of the health authorities.

# EXPERIENCES IN GREEN MANURING PADDY

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AT a time when there is an acute shortage of food crops, specially rice, a short note on green manuring of paddy for production of more rice will be of help and an incentive to the paddy growers of south India. Being a *mirasdar* at Chidambaram in the South Arcot district which has similar conditions as those prevailing in the Tanjore delta as far as cultivation of paddy is concerned, my experiences in improved farming, specially growing of green manure crops, will be particularly helpful to the Tanjore and south Arcot districts and in general to all the paddy growing areas. If every cultivator grows his own requirements of green manure in his own land instead of purchasing green leaf manure from outside, which is very prohibitive in cost in these days of transport difficulties, the cost of production of paddy can be considerably reduced with an increased yield of paddy. Any small quantity of rice produced through individual efforts over and above what we have been producing in the pre-war days, will go a long way in relieving the sufferings of our people due to the shortage of food crops, and thereby strengthening our efforts for the sure and complete defeat of the Axis powers.

### *Paddy cultivator and green manuring*

Among the many problems that confront the paddy grower in his efforts for production of more rice the problem of adequate manuring with green leaf manure ranks the foremost. It has been proved beyond doubt that Indian soils generally lack in organic matter which plays a very great part in improving the fertility of the soil. In paddy tracts as almost the whole of the cultivable lands has been brought under the plough, there is very little of waste lands from where green leaves could be collected and used as manure. Forests are few and are situated far away from cultivated areas and hence, from such places also there is very little scope of obtaining green leaves. What little of green stuff is available from distant places in cartloads is prohibitive in cost and the cultivator can hardly afford to pay high prices for green leaves, if he wishes to secure an economic production of crops. So the best that a paddy cultivator can with advantage do is to grow his own crops of green manures and plough them under the soil before transplanting paddy.

### *Value of green manuring*

It is needless for me to state that due to continued cropping without returning to the soil in the shape of manures what has been removed by the crops from the soil, the soil becomes depleted of its fertility and a shortage occurs of the essential elements which are so much important for economic crop production. Of these the most important element is nitrogen which helps plant growth. This very important constituent of soil fertility can be applied in several forms like cattle manure, oilcakes and artificial fertilizers. But the cheapest form of application is green manure. The cost of raising a green manure crop is very little beyond the cost of seed, and very little of aftercare is required except watching against trespass by cattle. The green manure crops besides supplying the vital element nitrogen, enrich the organic content of the soil and thus the physical nature of the soil is improved. A light loose soil is made more compact and retentive and a heavy clayey soil is made open and more easily worked with the plough and other implements. Saline soils are also improved and are made fit for production of good crops.

### *Selection of a green manure crop*

Having decided to grow a green manure crop, one should select the crop best suited to his lands. *Dhaincha*, a common green manure crop, is found suitable for all kinds of soils and comes up well even in saline soils. It gives a heavy yield of green leaves and an acre of produce is enough to manure two or three acres. *Kolinji* comes up well in light, loose, sandy soils which are not saline. Indigo is suited for light and heavy soils. *Pillipesara*, a very popular green manure crop, thrives very well in all kinds of soils in this tract. It is both a green manure crop and a fodder crop. It is sown a week or ten days previous to the

harvesting of paddy just as other green manure crops in January-February. It grows luxuriantly with the little of moisture that is available after the harvest of paddy. It starts flowering and fruiting within three months and pod collection for seed purposes can be started after the third month and goes on until the next crop is put in. In villages where *pillipesara* is grown poor people get employment and earn wages for three or four months in the off-season when they could get no other employment. There are reports showing that *pillipesara* seed is consumed as food for cattle and men. There is always a tendency on the part of some cultivators to reduce the seed rate as a measure of economy. For instance, when *dhaincha* is sown thin, the plants have a tendency to grow tall and woody. At the time when they are pulled out and incorporated into the soil more labour has to be engaged and greater expenses incurred. When grown as a pure crop a uniform rate of 25 to 30 lb. of seed per acre can be adopted for all green manure crops.

### *Personal experience*

I started growing green manure crops in my village some 10 years ago and today out of 400 acres nearly 300 acres are under green manures. Having a variety of soils almost all the green manure crops mentioned above have been under cultivation in my lands. Before the introduction of green manure crops I used to get on the average about 1,200 lb. of paddy per acre. By constantly growing green manure crops year after year the yield began to rise up gradually until a few years ago when the yield doubled. Now, on the average, I get about 2,500 lb. of paddy per acre. In conjunction with green manures I always use artificial fertilizers. As the green manure crops are not completely adequate in their supply of the essential elements they should be supplemented with artificial fertilizers like sulphate of ammonia, ammonium phosphate, bonemeal or super. Now, as no other fertilizer is available in the market I use large quantities of Parry's paddy fertilizer with good results. Certain alkaline soils which were once uneconomic wastes have been completely reclaimed by growing green manure crops in them. In short the yield of paddy in all my lands has been doubled and in some plots the yield has even exceeded this limit.

### *Mixing of green manure and pulse crops*

There is a practice in these parts to sow pulses like blackgram or greengram in the standing crops of paddy a week or even earlier previous to harvesting paddy. Many are under the mistaken impression that there is no chance to raise a green manure crop when a pulse crop which is paying very well on account of the rise in price now-a-days is to be taken. In fact a green manure crop and a pulse crop can be mixed and sown. The yield of the pulse is not affected nor the growth of the green manure crop is spoiled. By the time the pulse is harvested the green manure crop would have made a few inches of growth and only after the pulse is harvested the green manure crop puts on growth. I have always been getting a good yield of blackgram even when mixed with a green manure crop. In lands of average fertility the yield of blackgram is only 200 lb. an acre. But I get an average yield of 450 lb. due to green manuring my wetlands in conjunction with artificials. Lands which were not giving an yield of even 50 lb. of pulse are now capable of a return of above 400 lb. Indigo and blackgram can be mixed in the ratio of 1:3 and sown. *Pillipesara* also can be sown in the same proportion.

### *Conclusion*

In conclusion I have nothing more to add except saying once again that green manures are indispensable for enriching the soil and thereby increasing the production of crops. They lighten the burden of cost of production of crops under the present-day war conditions and ensures an increased return to the cultivator.

# INSECT PESTS OF DEHYDRATED MEAT AND FISH

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DEHYDRATED meat in very large quantities and dehydrated fish in fairly large amounts are being prepared in India. These products are generally put into tins and sealed to be opened and used later. As this industry is of recent development there was no information on the likelihood of insect pests infesting either the meat or the fish and causing loss.

Observations during the past few months show that there are two insects, both beetles, which can infest these products and make them unsuitable for use as human food. These insects are (i) the hide beetle whose scientific name is *Dermestes vulpinus* Fabr., which breeds in both dry meat and dry fish and (ii) the red-legged ham beetle whose scientific name is *Necrobia rufipes* Fabr., which breeds in dried fish.

### *The hide beetle (Dermestes vulpinus* Fabr.)

*Appearance:* This is a small rather flat beetle about two-fifth of an inch long. It looks black but has an underside covered with short silvery hairs. The young one of this beetle is a hairy grub. It is brownish black in colour and the long dark hairs make it difficult to see clearly the different parts of the grub's body.

*Reproduction:* The beetles lay eggs; grubs come out of the eggs and feed and grow and the grubs when full-grown burrow into holes in which they pass a short resting stage known as the pupal stage and from the pupae the beetles come out. The beetle can produce six generations in a year.

*Habits:* In India the beetles and grubs are known to feed on hides and silk-worm cocoons.

Recent observations show that they feed voraciously on dried meat and dried fish.

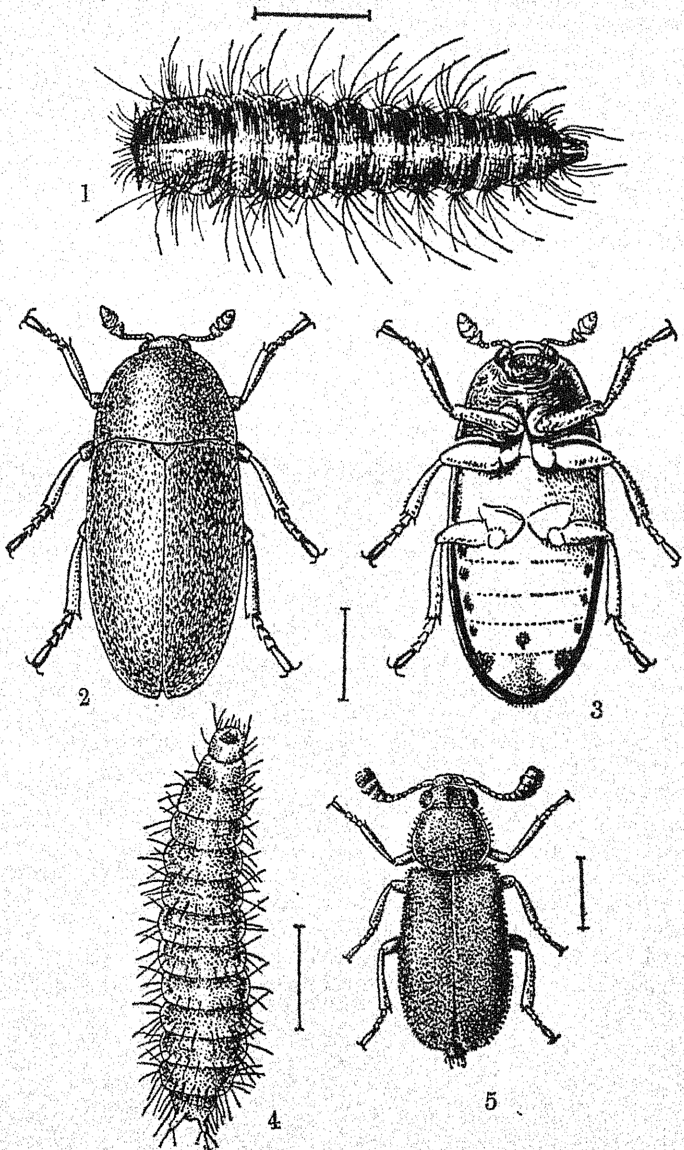

FIG. 1. Full grown larva of *Dermestes vulpinus*
FIG 2. Adult *D. vulpinus* Fabr.—dorsal view
FIG. 3. Adult *D. vulpinus*—ventral view
FIG. 4. Full grown larva of *Necrobia rufipes* Fabr.
FIG. 5. Adult *N. rufipes*

They keep away from light and can be found among folds of hides and in corners of hide godowns and among pieces of dried meat or dried fish. The beetles are often seen trying to enter buildings in which hides and dried meat are kept. Attracted by the smell from factories for dehydrated meat and fish they come to these factories in large numbers

*Prevention of damage :* To prevent damage by this insect to dried meat and dried fish it is necessary to build factories to be insect-proof by proper wire-netting of all openings and by having floors, walls and roofs constructed to be smooth and free from cracks. Absolute cleanliness in the factory and of factory hands is necessary. Arsenicated hides are not attacked by this pest.

### *The red-legged ham beetle* (*Necrobia rufipes* Fabr.)

*Appearance :* This is a very small beetle about one quarter inch long. The body is shiny metallic blue in colour. The legs are reddish. The young one of this beetle is an elongated greyish-white grub about two-fifth of an inch long.

*Reproduction :* The adult female lays eggs on the food material. From the eggs, the larvae, known ordinarily as grubs, hatch out. The larvae when fully grown turn into the resting pupal stage in a shining papery cocoon and from the pupa the beetle comes out.

*Habits :* The beetles and grubs are found feeding on stored ham and bacon and on the chitinous remains of insects. In India they have also been found feeding on salted sun-dried fish and also breeding in fish manure. In the Seychelles it is reported as breeding everywhere in salt fish.

Recently it has been seen infesting dehydrated and smoked fish in India.

*Control measures :* In the case of hams, the insect can be kept away by wrapping the hams tight in canvas. Factories for dehydrated fish should be built insect-proof with smooth crack-proof floors, walls and roofs and by having all openings protected with suitable wire gauze. Strict cleanliness should be enforced in the processing and packing rooms.

# LEAF-SPOT DISEASE OF APPLE IN KUMAUN

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A leaf-spot disease of apple caused by *Phyllosticta pirina* Sacc. occurs in every orchard in Kumaun. Shaw first recorded it at Ramgarh in 1918. Pear leaves are also affected by the same fungus. The disease first appears by the end of June and is in its most virulent form by the middle of August and continues till the leaf-fall in October. Due to the innumerable dead spots covering the leaf surface the normal photosynthesis is considerably hampered, which ultimately affects the growth of the trees. In severe cases the disease is responsible for yellowing and premature nakedness of trees. The young lesions on the leaves first show minute purple spots which later become sharp in outline with a slightly raised margin. The tissue round them becomes dirty grey in colour and in advanced stages the spots become zonate. Numerous minute black dots of spore masses or pycnidia are formed in the central dead region on the upper surface of the leaf. In wet weather these pycnospores scatter and infect fresh leaves. The diseased leaves fall below and all round the trees and in the following summer form numerous fruit bodies or perithecia of *Mycosphaerella* sp. Innumerable spores (ascospores) are ejected from these fruit bodies which are carried by air to new leaves and the disease thus recurs in the next season.

The parasitism of the fungus was established by a series of artificial inoculations and it was found that the fungus could enter through injured as well as uninjured surfaces of the leaf. Cross inoculation experiments showed that the fungus from apple could infect pear and *vice versa*. The incubation period of the fungus was from 9 to 12 days.

## Control measures

Bailey remarks, in his book entitled *Principles of Fruit growing*: 'There are four fundamental operations upon which all permanent success in most kinds of orchard culture depends, and their importance lies in something like the following order—tillage, fertilizing, pruning and spraying. Spraying is the last to be undertaken, but this fact should not obscure the importance of the other three'.

The successful control of this serious disease can be carried out by a thorough and timely spraying combined with proper orchard sanitation. Spraying experiments to control this disease were started in 1939. Bordeaux mixture 3:10:40 for the dormant stage; 2:10:40 for open cluster and petal fall stages, and lime-sulphur wash 1-10, 1-30 and 1-100 for dormant, open cluster and petal fall stages respectively were used for comparison. Bordeaux mixture was statistically superior to lime-sulphur in controlling the disease. It also prevented yellowing and premature leaf-fall. The cost of spraying including labour charges per tree came to annas six, which was rather high. Therefore another replicated experiment was carried out in 1942 to determine the minimum number of sprayings, stages at which the spraying should be done, and also the minimum strength of Bordeaux mixture to control the disease. Statistical analysis showed that only one spraying of 2:10:40 Bordeaux mixture done either at dormant, open cluster or petal fall stage was sufficiently effective to control the disease. The cost of spraying per tree including labour charges came to annas two only which was quite reasonable.

Spraying with Bordeaux mixture not only controls the leaf-spots on the trees but the spray fluid dripping below and around the trees kills the fungi persisting on old diseased fallen leaves.

As detailed above the fungus overwinters in the diseased fallen leaves which eject spores in the following summer. Therefore it is necessary that during winter all dead leaves be collected and burnt.

## Preparation of Bordeaux mixture

This should be prepared either in wooden or earthen vessels and never in metal containers. It is convenient to prepare the solution in lots of five gallons. Four ounces of copper sulphate of 98 per cent purity be first kept in a small muslin bag and hung half immersed overnight in two gallons of water kept in a vessel. In the second vessel dissolve 20 oz. of good quality quicklime (stone lime) in two gallons of water and leave it overnight. Next

morning pour out the solutions of copper sulphate and quicklime together into a third empty vessel and make this solution to five gallons by adding one gallon of water. Bordeaux mixture should always be prepared afresh and must be thoroughly stirred with a wooden stick before pouring it into the spraying machine. The pressure of the spraying machine throughout the spraying operation must be maintained up to 75 lb. per square inch. 'Four Oaks' spraying machine costing about Rs. 120 or Bucket sprayer costing Rs. 20 can be used for spraying. These machines can be had from Planters Stores, Calcutta or Bali & Co., Lahore.

## HOME CANNING

Successful home canning depends on destroying all microscopic life by using sufficient heat for the proper length of time and by using airtight containers to prevent re-infection. In this way, the natural tendency of fruits and vegetables to decay through the growth of bacteria, moulds, yeasts, and enzymes is counteracted.—*Canadian Note.*

# *TEJPAT* CULTIVATION IN SYLHET

S. Chowdhury
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*TEJPAT* (*Cinnamomum Tamala* and *C. obtusifolium*) is a native of India. It is a moderate sized evergreen tree of the Himalayas, rare from the Indus to the Sutlej, but common hence eastwards to east Bengal, the Khasia Hills and Burma.

In the district of Sylhet the most extensive plantations of *tejpat* are come across in the Jaintia parganas. The concentration of *tejpat* cultivation in this area is probably due to the fact that the plant was growing wild in this locality. These wild plants supplied the seed and seedlings for its extensive cultivation in the tract. In this tract a large number of the plantations are self-sown while others are planted. The area under the crop approximates about 600 acres.

## *Planting of seedlings*

Seedlings are raised in beds during the rains. Seeds are sown in seed beds in March-April and they sprout after a month or a month and a half. The seedlings are planted out permanently in the fields when they are four or five years of age. The seedlings are planted 10 to 15 ft. apart. The tree takes five or six years to grow, comes into bearing at ten and may continue to give annual crops for 50 to 100 years. After an orchard is established it is not necessary to make any further plantations; the ripe seeds fall from the trees in the soil and germinate. These self-sown seedlings when about a foot high are transplanted. Great care is bestowed upon them when they are young and tender. As constant exposure to the sun would kill the shoots, they are planted behind bushes or trees for protection. The undergrowth is kept down twice a year in the plantations for the first eight or nine years ; after that the jungle is cleared once a year in April. In some plantations the soil is dressed but in most cases it is never manured or cared for after planting. It is during the harvesting of the leaves that the plants are pruned haphazardly.

## *Harvesting*

*Tejpat* is plucked in dry and mild weather from October to December and in some places the collecting is continued to the month of March. The leaves are collected once a year from young trees, and every other year from old and weak ones. On an average 15 seers of dry leaves may be obtained from one tree, but the quantity depends upon circumstances ; a tree yields from 10 to 25 seers of dry leaves in a year.

In harvesting the *tejpat* the small branches are cut down with the leaves and dried in the sun for three or four days. The leafy branches are then tied up into convenient bundles ready for the market. In the other case the leaves are separated from the branches and packed in bamboo nets of a cylindrical shape called *bora* or *jungra*. The growers usually sell the garden to the *paikars* who pluck the leaves and send them to the different markets of the district and also outside to the neighbouring districts of Bengal.

## *Low cost of cultivation*

The cost of cultivation being very little it is a profitable crop. Raising of seedlings, jungle clearing and planting cost Rs 130 to 150 per acre. For the first eight or nine years after planting Rs. 50 to 60 are spent annually for keeping down the undergrowths ; thereafter the expenditure on this item comes to Rs. 20 to 25 a year. Harvesting costs nothing as the gardens are usually sold out to the *paikars* who make the plucking.

The produce from an acre amounts to Rs. 300 to Rs. 350 a year.

The leaves are used as spices in this district but can be employed with myrobalans in dyeing and in the manufacture of vinegar.

# A SUGGESTION IN TERMINOLOGY

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THE presence of two closely related species of important economic animals, as is the case of the two bovine species in this country, is commonly the cause of confusion in the terminology employed to differentiate between them. We have what we commonly call the cow and what is known as the buffalo, both very important in the economy of the country from the points of view of the milk they produce and of the work they do. Our buffalo is classified by biologists as *Bos bubalus*, and is stated to be native in Asia, including India, and other tropical areas. This particular word, buffalo, presents no special difficulties. It is what we commonly call the cow that presents a problem in terminology at times.

The term bovine, and probably cattle, technically refers to the genus *Bos*. The mature female of any species of this genus is a cow. In using the word cow loosely as we do, what we generally refer to as the cow, as contrasted to the buffalo, is the mature female of the species *Bos indicus*, whereas the term is applicable in the case of all other species of this genus as well, including the buffalo. We may sometimes go so far as to use the term cow in this country in reference to any member of the species *Bos indicus*, male or female, young or old. This species was, according to Webster's International Dictionary, referred to as the zebu for the first time in 1752 at the Paris Fair. The term was 'probably' taken from the Tibetan *zebu* or *zeba* meaning the hump of this particular bovine species or of the camel. The question here may stand or fall on the basis of whether the word cow or the word zebu should be considered as that word in the English language that should be accepted as the translation of the Hindi words गाय or साँड़ of which the first might be female zebu or zebu cow and the second male zebu or zebu bull. It would seem, however, that we might wisely use the terms zebu and buffalo rather than cow and buffalo to avoid the usual confusion we encounter in this case.

To illustrate such confusion as arises from the practice, as we now follow it, of using the term cow instead of zebu, we refer to milk that is produced by the two animals as cow's milk and buffalo's milk. We would be correct to say buffalo cow's milk, since the female buffalo is a cow in the strict sense of the word, but it would certainly be ambiguous to say cow cow's milk. The confusion at this point is very little when compared to others. If we are consistent in our practice we would find it necessary to refer to a bull or the mature male of the species *Bos indicus* as a cow bull, as contrasted to a buffalo bull. A cow bull may not be an impossibility, but if it should exist it would be a hermaphrodite of any one species of the genus *Bos*, not the mature normal male of *Bos indicus*! Likewise we should have to use the term cow calf, as contrasted to buffalo calf. Technically a member of any living species of this or any other genus cannot be both mature and young and immature at the same time, although the term cow calf means this. What, for example, would be a cow bullock?

Some persons might raise the question as to what then, if we refer to our animals as the zebu and buffalo, should be used in reference to members of species of this genus that have been imported from Western countries for purposes of cross breeding with our native animal, the zebu, or for maintaining pure for milk production. Biologists again help us out here by classifying our zebu's Western or European counterpart as of the species *Bos taurus*, of which there are two or more sub-species including *Bos taurus primigenius* and *Bos taurus longifrons*. We might refer to such animals in India as taurus cows, taurus bulls or taurus calves. Crossbred individuals might be referred to as either taurus-zebu crosses, zebu-taurus crosses (preferably) or in the usual manner such as Holstein-Sindhi, Jersey-Sindhi, etc.

The Indian languages have separate terms for the cow, calf of either sex or bull of *Bos indicus* and of *Bos bubalus*. The terms zebu and buffalo could be considered translations of these vernacular words. Since the Western animals are not indigenous to India there are probably no words in the Indian languages by which to distinguish them. The word taurus, on the other hand, could be used

directly in at least Hindi and Urdu without appreciable, if any, changes in its pronunciation. It might be spelled ज़ारस. If this is not acceptable, less confusion would result than now does if they were referred to in the same vernacular terms that are now used for other indigenous members of the species *Bos indicus*, although this is not recommended but probably already widely done.

It would be interesting at least to have other workers in this country make known any comments they may have on this suggestion. I think it will be useful in overcoming not only what confusion arises among ourselves, which is the more important, but what may arise in other countries where the zebu is known or is found. As a matter of fact workers in the United States Department of Agriculture do now distinguish the Indian animal from others found in the United States by referring to them generally as Brahmans or, less often I believe, zebu. This may be true likewise in Brazil, South Africa, the Philippines and Australia where importations of our zebu are found.

## HOW I CHOOSE A BULL

IF choosing a bull for my herd, I should want to see the extended pedigree with all milk records for all the females, together with the butter-fat tests taken. If this proved satisfactory I should want to go and see the bull. Having seen him, and, provided he was a useful animal, I should ask to see the dam. I should want to see what sort of udder she had and see if she had constitution. I should then want to see her dam if possible and note the same things as before -udder, etc. Then I should ask to see any daughters of the dam, full sisters to the bull I was buying if possible. I should like to know how they were milking and butter-fat testing. I would also try and find any other animals of the same family. Having satisfied myself on the female side, I should go and look at the sire and, if possible, the sire's dam. If she was not available I should ask to see a photograph. I should then ask to see any daughters by the bull that had sired the bull I was buying.

### *Need not be a champion*

Having seen all there was to be seen I should return to the bull and see if I thought that he was good enough on looks, although I do not think that looks are very important. However, don't get the idea that I do not want a good-looking animal; we all do, but they are very difficult to find. I consider that the first essentials are milk and butter-fat records. My bull must be a fair animal but he need not be a champion. If he has depth, length, and a good tail end and hind leg with a good spring of rib, I consider that you have the main essentials. I think that too many people take for too little notice of the sire's dam. In my opinion that is one of the most important points. You find most people buy a bull just because he is a nice colour or good to look at. —*H. M. Astley-Bell in The Dairy Farmer*, October, 1944.

# *What the Scientists are doing*

## COMPOSTING OF TOWN-WASTES

SUBSEQUENT to the report published in *Indian Farming* of December 1943, a good deal of further progress has been made in organizing compost production work in different provinces and states in India, under the Town Refuse Composting Scheme sponsored by the Imperial Council of Agricultural Research. Up to the end of October 1944, nearly 150 compost centres have been organized throughout the country and enough town refuse and night soil have been composted to yield about 3·5 million cubic feet (about 70,000 tons) of good quality compost manure.

In order to give a further stimulus to the production and distribution of manure under the above Scheme, the Government of India have agreed to pay a subsidy from the central revenues to provincial Governments at a rate rising upwards from 12 as. per ton, depending on the quantity of manure that is distributed to cultivators in the period *rabi* 1944 - *kharif* 1945 season. It is hoped that full advantage would be taken of this offer and that it would be possible to distribute 120,000 to 150,000 tons of well rotted compost manure to farmers in the above period.

No doubt, several difficulties were met with and had to be tackled in prosecuting the present Scheme on the large scale, under widely varying local conditions prevailing in different parts of India. It may be stated that the production side is now in full swing and what remains relate mainly to difficulties associated with the distribution side. The chief of these difficulties is the absence of cheap transport facilities for distributing the manure produced in the towns to the surrounding villages. Municipalities are being persuaded to purchase motor lorries for the purpose, but a good deal can be done if the agricultural and rural development departments concerned would themselves undertake the task of distributing the manure to farmers in their own lorries.

In view of the well-decomposed condition and innocuous nature of the final compost prepared, the prejudice existing among farmers in certain areas against manure prepared from town refuse and night soil is rapidly giving way to a faith in the usefulness of the manure ; but further active propaganda in the areas surrounding towns is necessary in order to create a market for the greatly increased quantity of town compost that is now under preparation. In this task, the help of the district staff maintained by the agricultural and rural development departments would prove specially valuable. Educated and literate farmers should be tackled first and be made to set the example to others in using a manure which in reality is fully decomposed and is similar to farmyard manure in appearance and properties.—C.N.A.

## TYPE CULTURE COLLECTION OF FUNGI

A type of work which does not receive much publicity but which is useful to the agricultural scientists, the industrialist and the university and college professor, is being quietly done in the Mycology Section of the Imperial Agricultural Research Institute at New Delhi. This is the maintaining of living cultures of those fungi that can be grown on artificial media and which are both our friends and our foes.

The Indian type culture collection of fungi was actually started in 1936, soon after the transfer of the Institute from Pusa, Bihar to India's Capital. Cultures were slowly gathered, identified and added to the culture collection. Soon requests began to be received for cultures from various workers in India and the work increased rapidly. It was discovered very early, however, that during the hot summer months, it is difficult to keep the cultures viable. Realizing the importance of the culture collection, the Government came to the rescue and sanctioned an adequate sum for constructing large cool-temperature-cabinets in the basement room of the Mycology Section. There are now three cabinets which are cooled by 'Freon' gas. They are, as a rule, maintained at a temperature of 15°, 20°, and 25°C. respectively. In addition the section has also been strengthened by the appointment of an Assistant who exclusively devotes all his time to this work.

Maintaining a type culture collection is a very difficult task. Some fungi can grow only

on certain special media ; some do not keep viable, even if there is favourable temperature, for long periods because of the accumulation of staling products as a result of their own metabolic activity. Mites are pests of fungal cultures and these minute insects move from tube to tube rendering the cultures impure or mouldy. Proper maintenance of fungal cultures is, therefore, a task needing much skill, care and quick thinking.

To scientists working in the various agricultural departments, authentic cultures of fungi are a necessity for comparing their own cultures, in order to find out whether they are dealing with already known or new fungi. To the professors teaching mycology in the universities and colleges, known cultures of fungi for teaching the fundamentals of the science, are also a necessity. To the industrialist wanting to prepare food-yeast, alcohol, citric acid etc. fungal cultures are equally important. The millowner wants moulds that destroy cloth stored under rather moist conditions, so that he can treat his fabrics in a suitable manner and see if these moulds can still damage his cloth. He wants amylase, an enzyme secreted by fungi, to desize his cloth. In all fermentation industries no work can be done without the aid of suitable fungi, like yeasts.

To all these different investigators the Indian type culture collection has tried to be of help and is doing so to the best of its ability. Cultures have been obtained from abroad ; from Holland cultures were secured only a week before that country was invaded and overrun by Germans. Cultures have been supplied widely to agricultural department mycologists, to professors, to biochemists and to industrialists. They have been supplied to workers in China also.—B.B.M.

## ARTIFICIAL INSEMINATION IN INDIA

THE majority of the calves born in our herd during the year were the result of artificial insemination. Raj Kumar, Reg. No. 0088, son of our late Sind Queen, sired 66 test-tube calves, bringing his total number of progeny by artificial insemination to 69. Three other bulls sired 9 calves; this makes a total of 75 test-tube calves during the year. Seven buffalo calves were born by artificial insemination, bringing the total to 8 such calves that we have produced at the Institute. We know of no other test-tube buffalo calves in the whole world.

By natural mating 47 calves resulted from 63 services, giving 74·6 per cent conception by cows (excluding buffaloes). The 75 test-tube calves were the result of 99 inseminations, which means 75·8 per cent conception. A comparison of birth weights and height at withers shows very little difference between the two groups.

We are now sending sperms by bicycle to inseminate cows in the city and short rail trips have also been made for the purpose of inseminating cows at a distance from Allahabad.—Extract from a report of the Allahabad Agricultural Institute—*The Allahabad Farmer*, September 1944.

# *What would you like to know?*

*Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.*

**Q. My wheat crop is attacked every year by (a) loose smut and (b) new bunt. What remedial measures can you suggest ?**

A. (a) Loose smut is caused by a fungus known to science as *Ustilago tritici* and is an internally seed-borne disease. The usual seed dressings which are excellent for controlling externally seed-borne diseases, are useless so far as this disease is concerned. It can be controlled in two ways : killing the internally borne infecting agent (*dormant mycelium*), by gently applying heat, so that it is killed without damaging the viability of the seed, and secondly by sowing immune varieties of wheat.

The seed which is suspected to be infected is, in the first method, soaked in water in shallow wooden tubs, early in the morning for about four hours. This is best done in the months of May and June when the day temperatures are very high. The soaked seed is then removed from the tubs, spread in the threshing floor and allowed to dry. During the soaking process the infecting agent is induced to germinate and exposure to the noon-day and the afternoon sun, for the purpose of drying, kills it. Almost total control of the disease has been secured by this process.

Several varieties of wheat have recently been evolved which are quite immune to loose smut. Most of them possess excellent agronomic and commercial qualities. Principal among them are Imperial Pusa 114, 120 and 165.

Please contact the Imperial Economic Botanist, Imperial Agricultural Research Institute, New Delhi, for seed and advice.

(b) The new bunt, or the '*Karnal bunt*' as it should be called, is due to a fungus known as *Neovossia indica*. The actual damage which the disease causes in normal years is not high, for there is no total destruction of the ears as in the previous disease. But the seeds (spores) of the fungus have a stinking and fishy odour which is capable of ruining even the healthy grain, making it unfit for human consumption. The disease is not seed-borne and its exact mode of transmission was discovered only in 1943. In the months of January and February if the temperature is suitably cold and there are rains, the seeds (spores) of the fungus lying in the soil germinate, giving rise to light, minute, sickle-shaped secondary seed (sporidia) which are wafted to the ears that have emerged from the boot leaf, by the convection currents. There they settle down and grow and when the grains are forming, attack them causing the diseased condition. As the disease is air-borne, seed treatments are of no use. Only such varieties of wheat that resist this disease, will ultimately control it and it is hoped to find them very soon.

BOTANISTS recognize over 150 species of the noxious weed, dodder. Some of the species attack one or a few plants only ; others will attack any plant that is available. The field dodder encountered in Canadian flax thrives on a wide variety of wild and cultivated plants.

## MADRAS

K. V. RAGHAVACHARI
*District Veterinary Officer, Erode*

THE Madras Livestock Improvement Act 1940 (Madras Act No. XIX of 1940) was passed on 3 September 1940. In amplification of the above Act the Madras Livestock Improvement Rules 1942 were passed on 21 January 1943. As already reported in the August 1943 number of *Indian Farming* the main provisions of the Act are:

(a) No person can keep without a licence from the Director of Veterinary Services or any other authorized officer a bull which has cut its two central permanent incissor teeth. No fee will be charged for the grant of such a licence.

(b) No licence will be granted to a bull which is unsuitable for stud purposes, either due to defects or disease and docs not belong to the particular breed recognized as suitable for the area.

(c) Compulsory castration of all such undesirable and unsuitable bulls when they cut their first pair of central incissor teeth. All such castrations will be done free of charge.

(d) The owner of a bull should produce its licence whenever required for inspection by the officers of the veterinary, agricultural and revenue departments.

(e) On demand, the keeper of a bull should also produce the licence to the owner of a cow when it is taken for service and before it is allowed to the bull.

(f) Penalty for violating any of the above rules under the Act is fine which may extend to Rs. 50 for the first time and Rs. 100 for subsequent offences.

(g) The licensing officer is empowered to seize, castrate and send to an infirmary or even auction any bulls that are unclaimed.

(h) The provisions of this Act shall not apply to any bull dedicated for religious purposes but notice of such dedication should be given to the licensing officer.

### *Enforcement and working of the Act*

The Government have ordered the enforcement of this Act in the Pollachi and Erode taluks of the Coimbatore district and the Periyakulam taluk of the Madura district with effect from 19 October 1943, since it was thought that these areas now contained fairly sufficient number of the right type and breed of bulls. The Kangayam breed of cattle is the most suitable and popular type in the above areas.

For the working of the Act each of the above three taluks was divided into two divisions, each one in charge of a touring veterinary assistant surgeon who was provided with a stockman compounder to assist him in his work. In the Pollachi taluk of the Coimbatore district the actual working of the Act was commenced on 1 December 1943. Up to the end of June 1944, the Act was enforced in 41 villages of the taluk and 1,686 scrub bulls unsuitable for breeding purposes were castrated under the provisions of the Act. In addition to the 18 approved breeding bulls in the taluk, licences were issued for 20 more bulls as suitable for breeding purposes. In the Erode taluk of the Coimbatore district, the Act was brought into effect on 1 January 1944 and up to the end of June 1944, it was enforced in 71 villages. The number of scrub bulls castrated under the Act was 246. The smallness of this number is due to the fact that most of the bulls in the taluk are true to the type of Kangayam breed and it is in this taluk that marvellous improvement has taken place. There are 45 approved stud bulls in this taluk and in addition licences were issued to 93 more bulls as suitable for breeding purposes. In the Periyakulam taluk of the Madura district, the Act was given effect to on 15 November 1943 and up to 30 June 1944, it was worked in 172 villages and hamlets. During the above period 1,624 scrub bulls were castrated under the Act and 16 bulls were given licences for use as stud bulls in addition to the 23 approved breeding bulls in the various schemes in the taluk.

The working of the Act has made a very good beginning as the cattle owners now realize

that proper improvement in the livestock can be achieved only by breeding from selected and true type of animals of the breed. The revenue authorities in the taluks are cooperating with the staff of the veterinary department in the matter of smooth working of the Act, by issuing proper instructions to the village officers, explaining the provisions of the Act and the results that would be achieved through their enforcement. As a mark of identification all the bulls for which licences are issued are tattooed with the letter 'L' in their left ear and those that were effectively castrated and made unfit for procreation are tattooed with the letter 'R'.

The number of bulls suitable for breeding purposes in each of the above three taluks is still too small for their cow population, and it is hoped that, not at a very distant date, these taluks will become not only self contained in their requirements of stud bulls but will also be able to cater to the requirements of other areas, where this Kangayam breed is popular and suitable.

### Livestock of Kistna district

The Kistna district consists of both delta and dry taluks. In the delta taluks cattle are better cared for and unwanted ones are not kept by the ryots, but in the dry taluks the number of cattle is large but they are not well-fed and cared for with the result that they are stunted in growth. They are chiefly kept for manurial purposes. The type of cattle found in this district is known as 'Kistna valley breed' which in itself is not a district breed and is akin to the Ongole breed of cattle. There is also another type of cattle in the district known as the 'Devarakota breed' which is also almost the same as the Ongole breed in build and conformation, but the colour of the animals is red and white. As it is the idea of the Government to grade up this local breed and bring the cattle to the level of the Ongole breed, ryots are advised to get good bulls from the Ongole breeding tract for stud purposes. To encourage the ryots to do so, such bulls are taken into the premium scheme and the owner paid a certain amount as premium on satisfying certain conditions. There are now 15 such stud bulls in the premium scheme. The Government have also introduced into the district the young bull scheme. Under this scheme young bulls about a year old are purchased and given to selected custodians for rearing. An annual subsidy is paid to such custodians for the proper care of these bulls until they come to breeding age. When once they begin to cover cows, the subsidy is stopped and the custodian is permitted to charge a certain fee for services performed by the bulls and appropriate the same to himself towards the maintenance of the bulls. After they complete two years at stud and perform the minimum number of services fixed they become the entire property of the custodians. There are at present 28 bulls in this scheme in the district.

### Buffaloes

The district is well advanced in the production of milk and milk products. Butter and ghee are exported from this district to Madras and other far-off places. For this purpose large numbers of buffaloes are kept by the ryots especially in the delta taluks. The breed of the buffalo is non-descript. They are like the Nagpuri buffaloes with long horns running horizontally backwards from the forehead. They are of medium size and yield, on an average, 4 to 6 lb. of milk per day. Male buffaloes are not used either for draught or for agricultural purposes and so male calves are neglected but the heifer calves are taken particular care of and fed well.

About 15 years back some of the zemindars and rich ryots imported into the district the Murrah buffalo cows and since then development of buffalo breeding is on the increase. The buffalo breeding station at Lam in the Guntur district has been the source of supply of buffalo bulls for stud purposes. Now there is great demand for these buffalo bulls in almost every village in the delta area. The Government have earmarked this district for buffalo development and so they encourage the ryots to purchase good Murrah buffalo bulls for stud purposes. Such bulls are taken into the premium scheme. There are at present 24 buffalo stud bulls in this scheme.

### One-day-cattle-shows

As a sort of encouragement to the ryots in the development of the cattle industry, one-day-cattle-shows are organized in the district both under the auspices of the Government and private owners and breeders. During last year three such shows were conducted exclusively for buffaloes and at one, a milking competition was also held where one Murrah buffalo cow gave 32 lb. of milk in 24 hours

and won the first prize. The zemindar of Muthyala conducted a cattle show at Kanchala entirely at his own expense and spent about Rs. 800 towards prizes for winning exhibits etc. It was open only to the animals of the tenants of his zemindari area.

# LARGE SCALE CROP SURVEYS IN PUNJAB AND U.P.

THE first large-scale crop surveys of their magnitude to be attempted in India or in any other country were carried out during the last season in the Punjab and the United Provinces at the instance of the Government of India.

In the Punjab, by sampling 108 out of a total of 9 million acres under wheat for experimental crop-cutting, the net outturn of the crop for the province was estimated at 3,448,700 tons with a sampling error of just over one per cent. The official estimate, under the old and on scientific method, was 3,277,000 tons—in defect by 171,700 tons. The cost of the survey barely exceeded Rs. 1,000 per district. The Government of India, it is understood, propose to extend the scheme to principal crops in all provinces where area statistics are known.

The scheme, which was devised by the Statistician to the Imperial Council of Agricultural Research and carried out by the Department of Agriculture, Punjab, had the two-fold objective of estimating the yield of wheat per acre and the total outturn and of evolving a large-scale sample technique for forming a reliable estimate of yield. It was conducted in 27 out of the 29 districts of the province, excluding Lyallpur and Simla.

### *How survey was conducted*

The plan adopted for the survey was based on the principle of random stratified sampling with *tehsils* as the strata, a village as the primary unit of sampling within a stratum, a field as the unit of sampling within a village and a plot 66 in. × 33 in. as the ultimate unit of sampling within a field. Uniformity of practice was obtained by central training of the senior staff concerned in all the details of the experiment, and also by central selection of the 748 villages (about 2 per cent of the total number available) used for the scheme.

These were, for each district of the province, proportionate in number to the area under wheat, but equally distributed amongst the *tehsils* of the district, and at random within each *tehsil*. Within each village three fields were selected (since previous experimentation had shown little difference between the variation between villages and that between the fields of a village, and practical considerations of time, labour and cost counselled concentration of fields within a village), and within each field one plot of 1-20th acre (the variation between plots in a field being less than that attributable to either source just mentioned). Selection of the fields in villages and of the plot in each field was by use of random numbers supplied by the centre, which was able to check the process. Harvesting, threshing, winnowing and weighing normally were completed in one day.

The final estimate includes adjustments for 'driage', owing to the divergence of this procedure, necessary for accuracy and speed, from the general practice which allows a week or two for drying between harvest and threshing, and also for the different yields of wheat sown pure or mixed with other crops.

# BIHAR

A. C. CHAUDHURI

*Incharge, Government Cattle Farm, Patna*

RECENTLY the Government of Bihar have approved of the opening of an Animal Husbandry Section. This section will be under the Veterinary Department. Steps have already been taken to appoint a suitable Animal Husbandry Officer to organize the section. The opening of such a section has been long overdue in this province and it is expected that if the activities of this section is directed properly it will benefit the livestock

industry of this province. In order to meet the present scarcity of animal products for food purposes certain schemes are already under consideration of the Department.

The Veterinary Disease Investigation Officer of the province carried out investigations on the viability of goat tissue virus of rinderpest under field conditions, which were undertaken in view of several complaints of failure in immunity. He found that the virus kept in the frigidaire (35°F.) for 24 hours during the rainy season, remains viable upto the sixth day, while the viability of the virus similarly kept at the room temperature (90°F.) remains of doubtful potency. He also found that the goat tissue virus emulsion when tested under field conditions (cloudy day) proved to be viable for 5 to 6 hours with proper precautions. An emulsion kept in shade and protected from direct sun rays remained viable for a period of 5 to 6 hours—the time which is usually taken to vaccinate a large herd of cattle (400 to 500).

The Poultry Disease Investigation Officer has made a complete survey of poultry diseases in the different districts of the province. He found that Doyle's disease is the commonest and most widespread of all the fowl diseases in the province. It sometimes sweeps away the entire poultry population of a village. He found no particular season for its occurrence though in some parts of the country it appeared generally after rains vanishing with the advent of summer. The mortality ranged from 95 to 100 per cent.

The Egg Grading Station at Patna graded 2,400 eggs in the month of September, 1944, valued approximately at Rs. 300.

During the quarter ending September 1944 there were seven authorized packers of ghee under the scheme of Agmark graded ghee in the districts of Darbhanga, Saran and Monghyr, where 3,111 md. of ghee valued approximately at Rs. 3,64,015 were graded. Several check samples of Agmark graded ghee were collected to ensure proper quality.

# ASSAM

V. R. Gopalakrishnan
*Veterinary Investigation Officer, Assam*

Due to the prevailing war conditions, the prices of livestock in general and of cattle in particular, have shown an upward tendency. This would appear inevitable as there is a growing demand both for civilian and military purposes. While the requirements of cattle for the Defence Forces in the province for transport and for meat is of paramount importance, the need for civilian use seems also urgent. As a result of the 'grow more food campaign' launched by Government, thousands of additional acres are being brought under cultivation for food crops, especially paddy. Increase in such agricultural operations would require more cattle for work in the field. Hence the farmers are advised to take special care of their animals and not to sell their plough cattle. It is also evident now-a-days that the cultivator pays more attention to and takes a better care of his cattle, probably due to the economic stress. It is a welcome sign and deserves help and encouragement.

### *Methods of improvement*

Improvement of cattle in Assam is an important problem to which much attention is paid now. The problem is sure to receive due consideration in the post-war reconstruction scheme for the agricultural development of the country. As it is, the improvement can be effected by the following three main methods: (1) Research in animal nutrition, (2) Cattle breeding, (3) Investigation and control of cattle diseases.

### *Animal nutrition*

Assam cattle are poor in condition and the milk yield in cows is also low. Although there are fairly extensive grazing areas in the province, it would appear that the poor physique and low milk yield of cattle are due more to nutritionally deficient quality of grass or fodder than to its insufficiency. To tackle this problem, a research scheme—Animal Nutrition Scheme—financed by the Imperial Council of Agricultural Research has been started with the object of

investigating nutritional defects responsible for these conditions. This is a fundamental study of much significance involving analysis of soil, grass, fodder, etc. and then conducting feeding experiments on indigenous cattle with a view to evolving a balanced ration suitable to the local conditions in Assam. Besides, improvement of grassland and grazing areas is being effected and encouragement is given for extension of fodder cultivation and for better utilization of existing fodder resources.

### Cattle breeding

Efforts are being made to popularize and encourage cattle breeding by farmers in the villages and also in a few private farms. Under the auspices of the Rural Development Scheme, a number of rural uplift centres have been opened and they serve the useful purpose of awakening the villagers towards improvement by propaganda and demonstration. In fact, the rural uplift centre forms the nucleus for the dissemination of knowledge, among other things, on cattle breeding, cattle welfare etc. for the villages around it. Supply of suitable bulls to the centres and castration of weedy ones are undertaken. The bulls are periodically inspected for any veterinary aid, if necessary. Besides, special instructions regarding better management of cattle and calf rearing are given.

A special feature peculiar to Assam in regard to cattle breeding is the maintenance of *khutis*. These are indigenous cattle breeding centres situated mainly in forest tracts and in extensive grazing areas near the banks of the Brahmaputra and its tributaries. Some *khutis* are also found in the *char*-lands or *char*-islands in the bed of the Brahmaputra. Facility for grazing is ample and water supply is sufficient. In these *khutis*, cattle breeding, buffalo breeding, sale of milk and its products, especially butter and ghee, are undertaken. Cultivators purchase bullocks and cows from these *khutis*. To improve breeding of cattle in *khutis*, sufficient number of suitable bulls are supplied as far as possible. Usually, cattle remain free and untethered in *khutis*, almost similar to ranch conditions.

### Control of cattle diseases

Contagious diseases are a serious menace to the cattle wealth of the province and retard cattle improvement. Rinderpest, the worst scourge of cattle, is now effectively controlled by vaccination with goat-tissue virus. This method of protection has now become very popular as its beneficial results are well known to the farmers. As some lakhs of cattle have so far been vaccinated, there is evidence of the decrease in mortality due to outbreaks of rinderpest. It is under consideration of the local Government to obtain goat tissue vaccine from Calcutta by air route so as to avoid the inevitable delay in transport at present. It will also facilitate more extensive immunization work in the province.

Bovine contagious pleuro-pneumonia or lung plague is a highly fatal specific infection affecting cattle in Assam. It ranks second only to rinderpest in the list of major diseases of cattle. The existence of the disease in Assam was confirmed in 1940-41 and field investigation has shown that the disease is prevalent only in the Brahmaputra Valley. Fortunately, it has so far remained restricted to this Valley but the spread of infection to other parts of the country is a potential menace. As the infection spreads in a slow and insidious manner, the prevalence of the disease during the early stages is usually overlooked by the cattle owners. Thus the outbreak gains a strong foothold in the herds and its effects are devastating. The affected animal develops pneumonia and pleurisy to which it ultimately succumbs. The mortality is high, viz. 60 to 70 per cent.

The control of this disease is an important problem now. It was one of the subjects for discussion in the Animal Husbandry Wing meeting in November 1942, in the Indian Science Congress, Calcutta, in January 1943 and in the meeting of the Agricultural and Animal Husbandry Section of the Assam Advisory Board for Development in April 1943. It was recommended that measures should at once be taken, if necessary by legislation, to ensure that the disease does not spread from its present area in Assam to adjacent territories and also to enforce vaccination in the affected area. Preliminary field trial of pleuro-pneumonia vaccine was carried out in 1943 and the product appeared safe for use in the field. A scheme for the control of bovine contagious pleuro-pneumonia in Assam is awaiting the sanction of the Imperial Council of Agricultural Research.

The control of these two major diseases will considerably reduce the cattle mortality and substantially help in improvement of cattle in Assam.

# HYDERABAD

M. M. A. RAHMAN, G.V.Sc., I.D.D.
*Livestock Officer*

SUBSIDIARY to the Nizam Sagar Development Scheme, Government sanctioned the distribution of 50 breeding bulls for the present in the Nizam Sagar area. By now 15 Malvi bulls have been posted in selected villages wherefrom demand for bulls was made. The keepers of these bulls, who are cultivators are given a subsidy of Rs. 10 per mensem towards their upkeep. Periodically the veterinary officer of the circle inspects these bulls and their progeny and checks the service records maintained by the keepers. Selected progeny of these bulls are registered and tattooed to form a pedigree herd.

Another drive to arouse the local zemindars' interest in cattle breeding is initiated in the way that those interested in cattle breeding are given 400 acres of land free of cost and also Rs. 10,000 free of interest for the first five years to maintain 100 Malvi cows on ranching system. Again, as a further help to the breeder it has been decided that typical male stock raised at his farm will be purchased by the Veterinary Department for distribution in the Malvi breeding area. The breeder has started the work with great enthusiasm and interest under the technical advice of the Department.

### *A side industry*

The canal irrigated area of Nizam Sagar has many facilities for the rearing of ducks. As such in consultation with the Director, Veterinary Department, the Government have provided Rs. 1,000 in the budget for taking up necessary steps to start this industry. Indian runner ducks have been chosen for the area, because, apart from forming a profitable side industry for cultivators, they eat the snails and thereby control the spread of fluke-disease. Up till now 180 ducks (one male to five females) have been distributed in 15 different villages to the interested cultivators on an agreement that they will increase their duck population by 50 per cent in a year. Further extension and organization of this industry is under the consideration of the Department.

### *Diseases of animals*

Investigation of diseases of livestock in the Hyderabad State has added to the knowledge of our field workers interesting and useful information, which is of great help in reducing the ravages of some of the fatal diseases and in enabling the livestock owners to maintain the efficiency of their animals.

A brief account of investigations into a few diseases is summarized here for the interest of general readers :

*Liver-fluke :* It has been causing an immense loss to the farmers of the Nizam Sagar area by wiping away thousands of their cattle for many years. A close study of the situation has enabled us to employ some control methods under which the losses have been reduced to a great extent.

The suggested programme for the control of the disease now launched out all over the area comprises of :

(1) Mass treatment of the diseased with carbon-tetrachloride and igitol in pregnant animals.

(2) Destruction of snails (intermediate host) by (a) mechanical (b) chemical (c) biological methods.

*Tuberculosis :* Double intradermal tuberculin test conducted at the Government as well as private farms has thrown light on the incidence of tuberculosis in milch cattle. In view of the importance of this disease to public health, the Veterinary Department has made arrangements for a free tuberculin test of the milch cattle of the public in the city of Hyderabad. And in addition to this, a further detailed technical survey of the disease has also been arranged to find out the necessity of employing the control methods of the disease.

*Surra in cattle (Bovine Trypanosomiasis) :* Acute outbreaks of this disease bring about a heavy toll of death among the cattle in the Telangana districts of the State. This disease was always mistaken by the field workers for anthrax ; therefore all the control methods employed proved futile. Now the cause and the course of the disease are well understood and a routine treatment with tartar emetic is carried on successfully.

*Rinderpest control :* As it is the most devastating contagious disease of the cattle, the Department, with the sanction of the Government, maintains a goat tissue vaccine depot at the

Director's office in Hyderabad. This depot maintains a regular and timely supply of tissue vaccine to the field workers. It issued 4,20,500 doses of tissue vaccine in one year and incurred an expense of O. S. Rs. 1812-4-4. Immunization of cattle against this disease by the tissue vaccine helped a great deal in bringing down the rate of mortality in cattle.

# MILK RECORDING NEWS

RECORDS for lactations completed during September 1944 have been received from five village milk recording centres under the Council. Fiftyfour cows and 31 buffaloes completed their lactations under record at these centres averaging 2,923 lb. and 4,974 lb. respectively. Records from individual centres are given below:

### *Hariana cows*

Beri area, Rohtak district, Punjab: Twenty-seven cows completed their lactations under record during September 1944, averaging 3,373 lb., with a maximum yield of 4,974 lb. and minimum yield of 2,128 lb. Selected records will be reproduced in the Milk Recording News for next month.

### *Sindhi cows*

Karachi and Hyderabad areas, Sind: Thirteen cows completed their lactations in September 1944 averaging 3,290 lb. The maximum yield was 7,352 lb. and minimum yield was 2,218 lb. Selected records are given below:

| Brand No. or name | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| KHA-THUR 46 | Mahomed S/o Punhoo Karmati | 3 | 3.7.43 | 425 | 7,352 | 28 |
| BHOOR 82 | Sabu S/o Jiand Jokhio | 2 | 4.11.43 | 282 | 4,455 | 23 |
| MORE | Sabu S/o Jiand Jokhio | 3 | 1.11.43 | 280 | 4,312 | 24 |
| BHOOR 2 | Sabu S/o Jiand Jokhio | 1 | 18.10.43 | 211 | 3,186 | 24 |
| PARI-KA | Watis S/o Rahmat-ullah | 1 | 10.11.43 | 296 | 3,502 | 16 |
| NAN-GEL | Watis S/o Rahmat-ullah | 1 | 25.1.44 | 230 | 2,976 | 16 |

### *Kankrej cows*

Sanand, Ahmedabad district, Bombay: Three cows completed their lactations during September 1944 under this scheme. Their records are as under:

| Brand No. or name | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 583 | Kalyan Kala | 2 | 4.1.44 | 243 | 2,228 | 15 |
| 603 | Kalyan Kala | 1 | 1.5.44 | 117 | 684 | 9·25 |
| 618 | Rama Viha | 2 | 16.6.44 | 70 | 441 | 9·25 |

### *Local cows*

Chata, Muttra district, U.P.: Eleven cows completed their lactations under record during September 1944. Their average yield for the completed lactations was 1,877 lb. with a maximum yield of 3,357 lb. and minimum yield of 810 lb. Selected records are as under:

| Brand No. or name | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| 28 | Khubi | 2 | 10.8.43 | 393 | 3,357 | 13 |
| 388 | Horful | 2 | 4.10.43 | 349 | 2,205 | 8 |
| 179 | Babulal | 2 | 8.1.44 | 240 | 1,992 | 12 |
| 371 | Chiddi | 1 | 28.7.43 | 403 | 2,395 | 9 |
| 128 | Hukumpal | 1 | 30.9.43 | 351 | 1,936 | 8 |

### *Local buffaloes*

Chata, Muttra district, U.P.: During September 1944, 11 buffaloes completed their lactations, averaging 3,209 lb., with a maximum yield of 4,800 lb. and minimum yield of 2,380 lb. Selected records are given below:

| Brand No. or name | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily record ed yield lb. |
|---|---|---|---|---|---|---|
| 154 | Tejpal | 2 | 5.11.43 | 302 | 3,382 | 14 |
| 146 | Harchand | 6 | 9.3.43 | 390 | 4,800 | 15 |
| 175 | Bahori | 1 | 15.8.43 | 384 | 4,130 | 12.5 |
| 294 | Beni | 3 | 1.7.43 | 434 | 3,933 | 14 |
| 239 | Ganeshi | 2 | 26.8.43 | 380 | 2,857 | 13 |
| 265 | Aijaz Husain | 1 | 29.8.43 | 376 | 2,835 | 11 |

### *Murrah buffaloes*

Meham, Rohtak district, Punjab : During September 1944, 20 buffaloes completed their lactations under record, with an average yield of 5,946 lb. The maximum yield was 7,969 lb. and the minimum yield was 4,572 lb. Selected records are given below :

| Brand No. | Name of owner | No. of lactation completed | Date of calving | Days in milk | Lactation yield lb. | Maximum daily recorded yield lb. |
|---|---|---|---|---|---|---|
| MM. 24 | Mahga S/o Taroo | 1 | 18.9.43 | 352 | 6,837 | 32 |
| MM. 1 | Mohd. Beg S/o Nawab Beg | 4 | 17.10.43 | 327 | 6,972 | 32 |
| MM. 254 | Isha Khan S/o Hakam Ali | 3 | 17.9.43 | 338 | 6,673 | 25 |
| MM. 149 | Jughi Ram S/o Kishanlal | 2 | 17.10.43 | 320 | 6,511 | 32 |
| MM. 73 | Shohlal S/o Udmi | 2 | 3.10.43 | 325 | 6,736 | 29 |
| MM. 97 | Nihala S/o Gi Sukh | 5 | 23.10.43 | 322 | 6,304 | 29 |
| MM. 93 | Bhartha S/o Ankha | 5 | 13.10.43 | 330 | 7,507 | 29 |
| ND. 27 | Teko S/o Sanohi Ram | 4 | 8.8.43 | 382 | 7,969 | 32 |

## MILK RECORDING NOT A NEW SYSTEM

MILK recording is not a new system. It was practised by the ancients thousands of years before the Christian era. In more recent times, before 900, A.D. milk recording was in common usage in the principality of Wales. In the summer time, the Welsh farmers migrated to the hills and turned their cows into untouched pasture. Every day the yield of each cow was recorded and poured into a common churn, each farmer later receiving his equitable share of butter and cheese, according to the yield of his cow on that day. The record was made by what was known as the Venedotian measure, and not by weight. The measure was in accordance with the code of Venedotia, the chief of the early States of Wales, and was a vessel of three thumbs width across the middle, nine thumbs accross the top, and nine thumbs diagonally. A thumb was about an inch, so that the Venedotian measure held about a gallon of milk. A normal cow was expected to give about two gallons of milk a day. Three-times-a-day milking was also well known in Wales in the twelfth century, and the month of May was known as the month of three milkings a day.

With regard to the ancient recording of milk, a frieze, representing a farm about 3,100 B.C. was recently unearthed in the excavations of Ur of the Chaldoes. It shows men milking cows in the barn, and in a room close by, officials pouring milk through a strainer into huge stone jars. Calves, duly muzzled, are tied to the cow's headstalls, to encourage the cows to give more milk.—*Dairy News Letter, Canada.*

# PRESERVING PERISHABLE FOOD BY QUICK FREEZING

E. G. HALL, B.Sc.(Agr.)

THE preservation of foods by freezing is not a recent development, but the present-day quick freezing industry is of recent origin. The slow freezing of meat, fish and poultry has been of commercial importance ever since the advent of artificial refrigeration early in the 19th century. Quick freezing of foods, as a commercial process, commenced in United States of America in 1918 with the development of an improved system for the rapid freezing of fish in brine.

The slow freezing of berry fruits has been practised in America for more than 30 years. But the quick freezing of fruits was not introduced until about 1930. On the other hand, the preservation of vegetables by freezing is a recent development, the first operations of commercial importance being carried out in 1930 by the General Foods Corporation.

### *Quick freezing and America's food supply*

The quick freezing industry in America is now firmly established as an essential part of the food industries in that country. But many difficulties not connected with the actual freezing and storage operations had to be overcome before this position could be achieved. These were principally control of the quality of the raw material, packaging problems, the many problems associated with the distribution of small packages of highly refrigerated material and the education of consumers in the acceptance of an entirely new product.

The development of quick freezing has enabled most perishable foods to be stored for long periods with little loss of palatability and nutritive value, and seasonal foods of high quality are now available in America all the year round.

The quick freezing industry is making an important contribution to the task of supplying America's war-time food requirements and the expansion of the industry since the war began has been rapid. At the present time the United States Armed Forces abroad, as well as in training camps within the country, are using large quantities of food preserved by quick freezing, the extent of this being indicated by the fact that they took about 70 million pounds of frozen vegetables alone in 1943. The total United States of America pack of quick frozen foods in 1943, including fruit, vegetables, seafoods, poultry and meat, exceeded 1,000 million pounds in quantity. In 1933 some 70 million pounds of fruit and 2 million pounds of vegetables were preserved by freezing, in 1943 the total pack of frozen fruit was 229 million pounds and the total pack of frozen vegetables was 231 million pounds.

### *Freezing of fruits*

Fresh fruits as a class are the most difficult of all products to preserve by freezing without causing radical changes in appearance, texture, flavour and colour, and practically all fruits require packing in syrup or with sugar or some other treatment to minimize these dangers. Most of the fruits frozen in America are berries, strawberries being most important, sour cherries are frozen extensively and apples and peaches are frozen to a lesser extent. The 1942 pack of 222 million pounds of quick frozen fruit consisted principally of strawberries (63 million pounds), cherries (52 million), raspberries (22 million), apples (16 million) and peaches (14 million pounds).

### *Maturity of fruits for freezing*

The maturity of the fruit selected is of very great importance. In general the fruit should be riper than for canning, that is, it should be picked in a prime eating-ripe condition. Immature fruit when frozen and subsequently thawed for use, is usually very sour, often bitter, lacking in colour and flavour, poor in texture and usually shows more browning and discolouration. Uniformity of maturity is of considerable importance ; this may require frequent picking, careful sorting and the discarding of portions of fruits which ripen unevenly.

### *Rating of varieties*

The rating of varieties for freezing is a difficult matter because the behaviour of a given variety in freezing preservation is affected considerably by climatic, soil and cultural practices. Furthermore, a variety which freezes well may be unsatisfactory commercially because of low, uneconomic yield or susceptibility to diseases or pests.

### *Freezing of fruit pulps and juices*

These are frozen to a considerable extent in United States of America, particularly pulps for the bakery, hotel and restaurant trade. They are much easier to handle than whole or sliced fruits, and often can be frozen satisfactorily without the addition of sugar. Certain varieties unsuitable for freezing whole or sliced can be frozen satisfactorily as pulp or juice.

### *Freezing of vegetables*

Freezing preservation, properly carried out, comes very close to preserving the natural fresh flavour of most vegetables, and is superior to canning. Frozen peas, lima beans, broccoli and others when cooked can scarcely be distinguished from the fresh vegetable. In general, vegetables which are commonly cooked before being eaten can be very satisfactorily preserved by quick freezing, and the following yield attractive products: peas, lima beans, sweet corn, broccoli, asparagus, snap beans, mushrooms, spinach, squash, carrots, rhubarb, turnips, beet, brussels sprouts and cauliflowers. Cabbages, potatoes, onions and pumpkins are the principal exceptions among those usually eaten cooked, and satisfactory methods for freezing these and salad vegetables have yet to be developed. The main attraction of salad vegetables is their crispness which is lost during freezing.

Peas are easily the most important vegetable frozen commercially in United States of America, as is shown by the following figures for the 1942 pack of 163 million pounds of frozen vegetables; peas (66 million pounds), lima beans (31 million), spinach (17 million), snap beans (14 million), and cut corn (10 million pounds).

### *Maturity of vegetables for freezing*

The maturity at which the vegetables are harvested and the extent of changes between harvesting and freezing are of critical importance in determining the quality of quick frozen vegetables. The vegetables must be harvested right at the time of highest quality and frozen as rapidly as possible after harvesting to keep post harvesting changes absolutely at a minimum. These points are of supreme importance in the case of peas, sweet corn, lima beans, asparagus and mushrooms, in which deterioration after harvesting is particularly rapid.

Asparagus should be young, tender and quite free from woodiness when harvested. Lima beans should be harvested while most of the beans are still green and immature. Sweet corn for freezing as whole grain should be harvested from one to two days less mature than for canning. Peas should be young, sweet and tender, but to ensure uniform maturity and, therefore, uniform quality in the final package, it is usually necessary to quality grade the shelled peas by floatation in brine before freezing.

### *Suitability of varieties of vegetables for freezing*

Varieties best for canning are not necessarily most suitable for preservation by freezing, and it has been necessary to select and develop special varieties for freezing preservation. As with fruits, the selection of varieties depends considerably on the climatic and soil conditions, where they are grown.

### *Quality control*

The key to the successful establishment and continued expansion of quick freezing is quality control. The maintenance of this high quality is primarily the growers' responsibility. Quick freezing adds nothing to the original quality, but if properly carried out preserves it better than any other known method of preservation.

Quality control begins with the selection of the proper kinds of varieties of fruits and vegetables, and demands a knowledge of the effects on quality of climate, soil and cultural practices. The most important part of quality control is harvesting exactly at the right stage of maturity; for example, starchy peas are almost inedible, and immature peas lack flavour and break up in processing, while woody asparagus and fibrous beans are just not wanted. In canning, the heat processing makes the product more tender; therefore relatively mature vegetables and relatively immature fruits may be used, but this is not so in freezing. Grading and inspection for diseased or infested material must be very carefully done.

It is particularly important that there should be as little delay as possible between harvesting and freezing, because of the rapid deterioration after harvesting of many vegetables and eating-ripe fruits. For this reason quick freezing plants should be located right in the centres of production so that the products can be frozen within a few hours after harvesting. For these reasons the development of quick freezing is tending to concentrate fruit and vegetable production in areas best suited to the production of high quality crops, irrespective of their distance from markets.

### *Conclusion*

Quick freezing is thus the logical method of handling perishable foodstuffs, and its general adoption will mean that time and distance will cease to be predominating factors in the distribution of perishable foods. By its use spoilage, which causes losses of up to 20 per cent. in fruits and vegetables, can be eliminated. The bulk of foods to be transported can be reduced by 50 per cent. and therefore retail handling costs can be cut by half, the housewife will buy no waste material and the tiresome job of preparing for cooking or for the table will be eliminated.

As most frozen fruits and vegetables are packed in various types of impregnated paper-board containers with an inner moisture- and vapour-proof lining, the preservation of these foods by freezing instead of canning effects a big saving in tin plate, which is very important in war-time. Further, the product occupies only about 50 per cent. of the space of canned fruits and vegetables, principally because the latter must be filled into the can fairly loosely in a liquid for effective heat penetration during processing.—Abstracted from *The Agricultural Gazette, New South Wales*, 1 October 1944.

## STRAWBERRIES ALL SEASON

RECENTLY developed varieties permit picking strawberries in a prairie garden almost continuously from late June until freeze-up. This is accomplished by growing both June-bearers, in the usual manner, and ever-bearers. Both early and late June-bearers are planted to extend the harvest of the main canning crop, says F. V. Hutton, Dominion Experimental Station, Morden, Man.

For best fall crop results everbearer plants are handled in the following manner : Set plants as early in the spring as the soil is fit to work. Choose only young well-grown plants as indicated by abundant light-coloured roots. Roots on old plants are yellowish to dark brown. Trim off all but two young healthy leaves and set crown level with soil surface. Space plants 18 in. in the rows, with rows 4 ft. apart. Pick off all flower buds until early July to promote early and strong vegetative growth. When young plants are rooting place runners so that all sets are evenly spaced at 6 in. or more intervals. Five young plants rooted from each parent will give a good stand. Only one plant should be rooted on each runner. A small clod of earth placed on the runner near the young plant will keep the young plant in place. If time cannot be spared for hand setting, light cultivation, sufficient to cover the runners with soil, will help encourage rooting.

After the runners have rooted, the parent plant and many of the sets will throw up flower buds and the new crop should commence to ripen in August or September. When the runners are well set the patch should be mulched with fine straw, grass clippings or peat moss, to give the soil a light protective covering and keep the fruit off the earth. Everbearer varieties commonly grown are Gem, Sparta, Mastodon and Wayzata. Gem is hardy, a prolific plant maker, moderately free of disease and produces a generous crop of early berries which are somewhat acidic. The berries, however, preserve well. The fruit stems are short and do not rise far above the ground.

Sparta is of recent origin but is outstanding in hardiness, disease resistance and in high quality and size of fruit. It does not make as many plants as Gem, or fruit as heavily, but has other superior qualities. Mastodon is late maturing and sometimes sets but few plants. Wayzata is early maturing and the berries are of highest quality, but it makes very few sets unless irrigated.—*Department of Agriculture, Canada.*

# *New Books and Reviews*

## SOIL EROSION

By Sir Harold Glover (Oxford University Press, Bombay, 1944, p. 32 As. 6.)

A short but clear account of soil erosion problems as they affect India, emphasizing the part played in the intensification of this man-made evil by the reckless clearance of the forest, uncontrolled grazing and faulty cultivation of undulating areas. The pamphlet in Part I after indicating the consequences of the lack of attention goes on to outline briefly the types of erosion, the influence of the natural vegetation cover and the several primary causes in a simple but effective manner. Attention is also drawn to the fact that the loss of fertile soil is not the only damage which lack of attention to the checking of the influence of these causes of loss, produces. The bearing of these causes, in premis the denudation of forests in the higher altitudes, on rainfall, communications, irrigation and other features is described. Part II is devoted to soil conservation as applied to Peninsular India, the Indo-Gangetic plains and the Himalayan foot-hills. The conditions prevailing in each and the steps now being taken are briefly dealt with. The chief remedies lie in a systematic re-afforestation of the upper catchment areas and hill sides, the limitation of grazing and its replacement by stall-feeding and better agricultural practices, as contour bunding and cultivation. 'When the natural balances which man has disturbed has been restored, then and then only will the soil be rendered stable and man and his animals will live again in harmony with their surroundings.'—R.G.A.

## BEEKEEPING IN INDIA

Bhupen Apiaries (Himalayas), Jeolikote, Nainital, U. P., 1944, pp. 28, Illustrated, As. 12.)

THE pamphlet is an addition to the list of others of the type lately issued on beekeeping and other cottage industries by different organizations and Government Departments interested in the welfare of the cultivators. It answers in simple language the questions usually asked by those who are planning to take up beekeeping as a side line and is likely to arouse in the readers interest in this delightful and profitable hobby. The publication is full of practical advice and discusses the species of Indian honey-bees, the organization and life of a bee colony, old and modern methods of bee-keeping, bee appliances and their uses and up-to-date methods of bee management. The discussion about bee-stings in detail is opportune and will allay the misgivings of many an unbeliever.

The pamphlet is profusely illustrated, but whether the illustrations are original or taken from other sources is not stated. One glaring shortcoming from which the publication suffers is that the account of the honey plants is relegated to the fag end and only a passing reference is made to them. They deserve a more thorough treatment even in a pamphlet of this type since a detailed knowledge by the beekeeper about them is as important for honey production as the successful management of bees.—K.A.R.

NITROGEN is vital to war effort for two reasons; for the production of munitions of different kinds, and for the production of food.

## JOINT FARMING

[In response to a request for the contribution of suitable articles on estate, consolidated, corporate or cooperative farming the following note was received from the Registrar of Co-operative Societies, C.P. and Berar, outlining the possibilities of starting cooperative farming activities in the province which may be of general interest. We shall be glad to receive a series of short articles dealing with all forms of corporate and cooperative farming in operation or under planning in any part of India for publication in this journal.

The object is to collect all available information on the subject and to publish exact details of their working and of the results obtained so far, in order to stimulate public interest in those special forms of agricultural development in India—Ed.]

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OUR cooperative activities in directions other than credit are still in their initial stages. We have yet to gather a lot of experience before we can think of the most complicated form of cooperative activity which is required in cooperative or joint farming. Joint farming is practicable in this province only in respect of compact agricultural colonies of ex-soldiers who with their discipline, experience of executive work and broad outlook can work harmoniously and efficiently in such cooperative institutions. Ex-soldiers can take to joint farming activities from the very outset and even undertake the breaking up of land allotted to them. They can collectively own tractors and other mechanized agricultural implements.

In other areas joint farming will be a difficult proposition. Village traditions and customs will be the chief obstacle. The second obstacle is in the land laws of the province under which the interests of one class of land holders run counter to those of another class. Joint farming in such areas should therefore be a matter of evolution from simpler forms of cooperative activities. A village may start with a multi-purpose society such as a cooperative fencing society under which blocks of fields are included in a single fencing, or a cooperative pig-killing society, or a cooperative tractor society and so on. Joint farming which involves hundred and one functions will be beyond the practical limitations of our villages.

Even if cooperative education and cooperative trading become universal in the villages, joint farming will depend quite a lot on reforms in the land laws of the province. It will also depend on centralized control of marketing and of prices of agricultural produce. Such control may be either from the State or from a central federal institution of all joint farming societies in the province.

Joint farming in some cases is a necessity and even under the existing conditions we have cases of *barais* who cultivate betel leaves (*pan*) on a joint farming model. A reference to the *wajib-ul-arz* of *malguzari mahals* of *pan* growers shows that for *pan* cultivation the cultivators have to agree to conditions which severely modify the *malguzari* laws. *Barais* jointly cultivate blocks of land about 40 to 100 acres in extent.

Joint farming is a practical proposition in the case of ex-soldiers settling on compact blocks of land held on one single type of tenure. Further, joint farming in such cases is not merely a practical possibility but also a necessity. The size of ex-soldiers' joint farm will depend on the capacity of tractors and other machinery which they can invest. If a colony has only one good tractor it can perhaps cultivate about 600 acres of land.

# INDIAN FARMING

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